

# Results of Research in 1960

by the

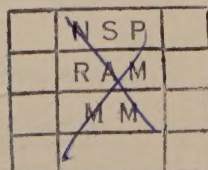
Agricultural Experiment Station

of the

University of Kentucky



(Filing Code 24-2-1)



*73d Annual Report  
of the Director*



## LETTER OF TRANSMITTAL

*To His Excellency, Hon. Bert T. Combs,  
Governor of Kentucky*

Sir: In accordance with an act of Congress, approved March 2, 1887, entitled, "An act to establish Agricultural Experiment Stations, in connection with the Agricultural Colleges established in the several states under the provisions of an act approved July 2, 1862, and under the acts supplementary thereto," and of the act of the Legislature of the State of Kentucky, approved February 20, 1888, entitled, "An act to accept the provisions of an act passed by the Congress of the United States, approved March 2, 1887, for the establishment and maintenance of Agricultural Experiment Stations in connection with Agricultural Colleges established by the several states and territories under the act of Congress approved July 2, 1862," I herewith submit the seventy-third annual report of the Kentucky Agricultural Experiment Station for the period ended Dec. 31, 1960.

Very respectfully,  
William A. Seay, Acting Director

June 30, 1961

# UNIVERSITY OF KENTUCKY

## BOARD OF TRUSTEES, 1960

Bert T. Combs, Governor, Chairman, ex-officio  
Wendell P. Butler, Superintendent of Public Instruction, ex-officio  
Emerson Beauchamp, Commissioner of Agriculture, ex-officio  
Mrs. Paul G. Blazer, Ashland, Boyd County  
R. P. Hobson, Louisville, Jefferson County  
Harper Gatton, Louisville, Jefferson County  
Wood Hannah, Sr., Prospect, Jefferson County

Robert Ward Bushart, Fulton, Hickman County  
Hershell B. Murray, West Liberty, Morgan County  
J. Stephens Watkins, Lexington, Fayette County  
Dr. Ralph Angelucci, Lexington, Fayette County  
Paul B. Hall, Paintsville, Johnson County  
Clifford E. Smith, Frankfort, Franklin County  
Floyd H. Wright, Lexington, Fayette County  
Robert Hillenmeyer, Lexington, Fayette County

## AGRICULTURAL EXPERIMENT STATION STAFF

*Fiscal year, July 1, 1959-June 30, 1960*

### ADMINISTRATION

Frank G. Dickey, President  
Frank J. Welch, Dean and Director  
W. A. Seay, Vice Director  
W. F. Garrigus, Associate Director  
Frank D. Peterson, Vice President of Business Administration  
G. J. Ruschell, Administrative Assistant

### AGRICULTURAL ECONOMICS

Brown, A. J., Department Head and Professor  
Binkley, Wendell C., Associate Professor  
Bondurant, J. H., Professor  
Byers, George B., Professor  
Card, Dana G., Professor  
Clark, Carl M., Associate Professor  
Criswell, James L., Assistant Professor  
Fuqua, Joe, Assistant Professor  
Gooch, Ernest D., Jr., Assistant Professor  
Halter, Albert N., Associate Professor  
Johnson, Paul R., Assistant Professor  
Keller, Luther H., Instructor  
Minton, Willard H., Assistant Professor  
Paris, Donald, Assistant in Agricultural Economics  
Pearson, James L., Assistant Professor  
Phillips, C. D., Professor  
Redman, J. C., Professor  
Roberts, John B., Professor  
Rudd, Robert W., Professor  
Smith, Eldon D., Associate Professor  
Shuffett, Dallas M., Associate Professor  
Thompson, James F., Associate Professor

Harrison, John S., Instructor  
Hatfield, Albert L., Assistant Professor  
Henson, Lawrence, Associate Professor  
Hiatt, Andrew J., Assistant Professor. Effective 2/8/60  
Hutcheson, Thomas B., Jr., Associate Professor  
Johnson, E. M., Professor  
Link, Leo A., Assistant Agronomist  
Loeffel, Frank A., Associate Professor  
Massey, Herbert F., Professor  
McMakin, William, Assistant Agronomist. Resigned 9/15/59  
Richards, H. R., Assistant Professor  
Shane, James F., Assistant Professor  
Stokes, Granville W., Associate Professor  
Stroube, William H., Associate Professor  
Taylor, N. L., Associate Professor  
Taylor, T. H., Associate Professor  
Templeton, William C., Jr., Associate Professor  
Todd, Jack R., Assistant Professor  
Valleau, W. D., Distinguished Professor of Plant Pathology  
Wallace, Allen M., Assistant Professor

### AGRICULTURAL ENGINEERING

Parker, Blaine F., Department Head and Professor  
Brooks, Jesse B., Associate Professor  
Kelley, James B., Professor  
Smith, Edward M., Associate Professor  
Smith, Samuel Warren, Assistant in Agricultural Engineering

### AGRONOMY

Webster, G. T., Department Head and Professor  
Amos, Dan F., Instructor. Effective 7/1/59  
Atkinson, W. O., Assistant Professor  
Bortner, C. E., Professor  
Chapman, Richard A., Professor  
Burrus, Paul B., Jr., Assistant Professor  
Diachun, Stephen, Professor  
Dicken, John C., Manager of Seed Stocks  
Doll, Eugene C., Associate Professor  
Duncan, William G., Associate Professor. Effective 9/1/59  
Evans, Kenneth, Assistant Professor  
Fallis, Robert W., Assistant in Agronomy  
Fergus, E. N., Professor  
Finkner, Verne C., Associate Professor  
Freeman, J. F., Associate Professor  
Griffith, Robert B., Agronomist. Resigned 10/21/59  
Hamilton, James L., Assistant Professor

### ANIMAL HUSBANDRY

Garrigus, Wesley P., Head of Department and Professor of Animal Husbandry  
Ayer, R. L., Assistant in Animal Husbandry  
Barber, Harald, Head Herdsman  
Barnhart, Charles E., Professor  
Boyd, Leory H., Assistant in Animal Husbandry  
Bradley, Neil W., Assistant Professor  
Buck, Charles F., Associate Professor  
Cathey, Ted W., Assistant in Animal Husbandry  
Dutt, Ray H., Professor  
Ford, Elizabeth, Technician  
Grainger, Robert B., Associate Professor  
Hall, Robert J., Assistant in Animal Husbandry  
Hamilton, O. D., Laboratory Assistant  
Henry, Amanda H., Assistant in Animal Nutrition  
Hicks, Robert, Assistant Professor. Resigned 1/31/60  
Kemp, James D., Professor  
Selke, Marvin Ray, Instructor. Effective 2/1/60  
Shimfessel, Othal, Assistant in Animal Husbandry  
Steele, Dewey G., Professor  
Stroud, John W., Assistant Professor. Resigned 6/13/60  
Varney, William Y., Assistant Professor



Wachs, Elizabeth F., Technician  
Whitaker, M. D., Assistant in Animal  
Husbandry  
Woolfolk, Patch G., Professor

#### ANIMAL PATHOLOGY

Hull, F. E., Department Head and  
Professor  
Baker, Alice J., Assistant in Animal  
Pathology. Resigned 3/26/60  
Behlow, Robert F., Professor  
Bryans, John T., Professor  
Doll, Elvis R., Professor  
Drudge, Harold, Professor  
Johnson, Catherine B., Assistant  
Bacteriologist  
Leland, Stanley E., Professor  
Lyons, Eugene, Assistant Professor.  
Resigned 5/31/60  
McCullum, William H., Professor  
Mangelsen, Dorothea J., Assistant in  
Animal Pathology. Effective 6/6/60  
Ridley, Robert K., Assistant in Animal  
Pathology. Effective 6/1/60  
Shepard, Barbara P., Assistant Professor.  
Effective 2/15/60  
Smith, Alice G., Assistant in Animal  
Pathology. Resigned 9/1/59  
Wilson, James C., Assistant Professor.  
Effective 11/1/59  
Wyant, Zae W., Technician

#### CREAMERY LICENSE

Williamson, Glynn E., In Charge of  
Creamery License Section  
Brown, Joe B., Inspector  
Cox, Ben W., Technician  
Foster, James D., Inspector  
Whitehead, Samuel D., Inspector

#### DAIRY SCIENCE

Seath, Dwight M., Head of Department  
and Professor of Dairying  
Bucy, John L., Field Agent  
Dowden, Donald R., Instructor in  
Dairying. Resigned 5/31/60  
Freeman, T. R., Professor of Dairying  
Glenn, Wilburn E., Assistant Professor  
Graden, Arthur P., Instructor. Effective  
3/1/60  
Howard, Ted, Instructor. Resigned  
2/29/60  
Jacobson, Don R., Associate Professor  
Lewallen, William F., Assistant in  
Dairying. Resigned 10/9/59  
Miller, William M., Instructor  
Olds, Durward, Professor  
Ridgeway, Billy T., Assistant in Dairying.  
Resigned 1/23/60  
Rudnick, Arthur Jr., Assistant Professor  
Walton, Robert E., Assistant Professor

#### ENTOMOLOGY AND BOTANY

Towsend, L. H., Department Head and  
Professor of Agricultural Entomology  
Baugh, Lucy, Seed Analyst  
Deen, Encil, Seed Technologist  
Hensley, Claude, Nursery and Seed  
Inspector  
Morton, Margaret, Seed Analyst  
McDaniel, Alice, Seed Analyst  
Rodriguez, J. G., Associate Professor  
Starks, Kenneth, Assistant Professor  
Thurston, Richard, Associate Professor  
Tilson, Howard G., State Entomologist  
Todd, Anne F., Seed Analyst  
Wiles, Mabel, Seed Analyst

#### FEED AND FERTILIZER

Poundstone, Bruce, Head of Department  
Adair, John T., Assistant Chemist  
Allen, Harry, Chief Chemist  
Caudill, Paul R., Chemist  
Daugherty, David M., Inspector of  
Registration. Leave 5/4/59 through  
6/30/61  
Davis, Maurice M., Assistant Inspector  
Dawson, Jo Ann, Assistant Chemist  
Ellis, John H., Assistant Chemist,  
Effective 8/1/59  
Gault, Lela H., Assistant Chemist  
Holbrook, Norma M., Assistant Chemist  
Howard, N. J., Inspector

Huffman, Wilfred, Acting Registration  
Inspector  
Hulette, Neville, Feed Inspector  
Leslie, Gary P., Assistant Chemist.  
Resigned 10/8/59  
Mathews, Robert, Chief Inspector and  
Administrative Assistant  
Midkiff, Valva, Chemist  
Newman, Dewey H., Jr., Assistant  
Chemist  
Price, Robert N., Assistant Chemist  
Routt, Wilson, Assistant Inspector  
Shrader, J. A., Microscopist  
Terrell, Harris W., Jr., Associate Chemist.  
Effective 4/11/60  
Wheeler, Otis R., Assistant Inspector  
Zichefoose, Guy, Auditor and Inspector

#### HOME ECONOMICS

Marlatt, Abby L., Director of School of  
Home Economics and Professor of  
Home Economics  
Boyd, Ruth, Assistant Professor  
Erickson, Statie, Distinguished Professor  
of Home Economics  
Magruder, Lucille, Assistant Professor  
Marshall, Helen R., Associate Professor  
Skerski, Gertrude M., Assistant Professor  
Wells, Claudia E., Assistant Professor  
Wightman, Mildred R., Assistant  
Professor  
Zinn, Mary N., Assistant in Home  
Economics. Resigned 8/31/59

#### HORTICULTURE

Schneider, G. W., Head of Department  
Abernathie, Jan W., Assistant Professor.  
Effective 8/1/59  
Armstrong, W. D., Horticulturist  
Chaplin, Carl E., Associate Professor  
Cotter, Donald J., Assistant Professor  
Davenport, O. M., Professor  
Emmert, E. M., Professor  
Herron, James, Associate Professor  
Kelley, James D., Assistant Professor  
Knavel, Dean E., Assistant Professor  
Martin, Dudley C., Assistant Professor  
Murphy, Sallie B., Technician. Effective  
1/28/60  
Waltman, C. S., Professor

#### POULTRY SCIENCE

Insko, Wyatt Marion, Jr., Head of  
Department and Professor of Poultry  
Abbott, Okra Jr., Associate Professor.  
Effective 2/1/60  
Begin, John J., Assistant Professor  
Johnson, Thomas H., Assistant in Poultry  
MacLaury, Donald W., Professor  
Tuttle, John W., Field Agent in Poultry  
Improvement  
White, John C., Assistant Professor

#### PUBLIC INFORMATION

Smith, J. Allan, Department Head and  
Professor of Public Information and  
Educational Aids  
Duncan, Joseph T., Associate Professor

#### ROBINSON SUBSTATION

Derrickson, C. M., Superintendent  
Noble, Milton, Forester

#### RURAL SOCIOLOGY

Coleman, Amos L., Department Head and  
Professor of Rural Sociology  
Ford, Thomas R., Associate Professor  
Brown, James S., Associate Professor  
Coughenour, Charles M., Associate  
Professor  
Danley, Robert Allen, Associate Professor.  
Resigned 6/30/59  
Mayhew, Earl, Associate Rural Sociologist.  
Resigned 10/2/59  
Pearsall, Marian, Associate Professor  
Schwarzweiler, Harry K., Assistant  
Professor

#### WESTERN KENTUCKY SUBSTATION

Lowry, S. J., Superintendent  
Caldwell, L. M., Assistant Superintendent  
Overfield, James R., Assistant in Animal  
Husbandry

## RESULTS OF RESEARCH IN 1960

by the

Kentucky Agricultural Experiment Station

THE PURPOSE of this report is to put on record the general scope of work and some of the principal findings of the various active projects of the Kentucky Agricultural Experiment Station in 1960. As most of the findings are for one year only, they may be incomplete or inconclusive unless viewed in relation to the findings of other years—in the past or still to come.

### AGRICULTURAL ECONOMICS

**Louisville wholesale market for fresh fruits and vegetables.**—City produce markets have been under considerable pressure during the past twenty years because of changing conditions in production, in handling at wholesale level, and in methods of retailing fresh fruits and vegetables. Locally produced fresh fruits and vegetables close to most metropolitan areas are providing an ever-decreasing proportion of the total; there has been a significant decrease during the period in per-capita consumption of fresh fruits and vegetables; and food retailing has gone through revolutionary changes from a system dominated by the small corner store to one dominated by the large supermarkets, many controlled by corporate chains with centralized procurement policies. This situation has led to direct buying from shipping points rather than at city produce markets.

The volume of fruits and vegetables handled on the Louisville market, however, has steadily increased. Total was 13,012 carloads in 1959, 11,598 in 1948, and 9,605 in 1937. Locally grown produce accounted for only 924 carloads, or 7 percent, in 1959; 1,669 carloads in 1948; and 3,271 in 1937. Truck receipts increased to 7,815 carloads in 1959 from 5,600 in 1948 and 2,225 in 1937. There was little difference in rail receipts for the three years.

The Louisville Wholesale Market for fresh fruits and vegetables has definitely decentralized during the past 20 years. In 1937 almost all wholesaling was done in the Haymarket district. In 1959, 52.1 percent was unloaded at the new Louisville Produce Terminal, 22.6 percent in the Haymarket district, 20.1 percent at chain store warehouses, and 5.2 percent at processing plants.

Considering final sales, receivers at the Produce Terminal handled 54.4 percent of the supplies handled in Louisville; service wholesales, 11.9 percent; jobbers, 2.1 percent and repackers 14.0 percent. Service wholesalers located in the old market close to the Haymarket handled 14.9 percent, and jobbers 2.7 percent of the receipts being sold by wholesale dealers.—C. D. Phillips.



**Efficiency of market movement of beef cattle and beef products in Kentucky.**—In the first phase of this study, data were collected to determine the relationship of marketings, slaughter, and consumption in relatively homogeneous geographical areas. Estimates of the net balance of livestock slaughter and meat consumption provide a basis for evaluating the efficiency of gross movement of livestock and meats among areas. The state was divided into 3 areas—western, central and eastern.

Annual averages for the years 1956-58 were as follows:

| Area          | Number of Cattle |           |             |
|---------------|------------------|-----------|-------------|
|               | Marketings       | Slaughter | Consumption |
| Western ..... | 135,100          | 22,000    | 63,500      |
| Central ..... | 302,900          | 202,100   | 241,300     |
| Eastern ..... | 75,400           | 10,800    | 109,200     |
| TOTAL .....   | 513,400          | 235,000   | 414,000     |

These data show that slaughter by areas and in total is considerably below marketings. Consumption is substantially larger than slaughter but less than marketings.

The fact that these differences exist does not necessarily imply inefficiencies in the movement of beef cattle and beef products. Factors that have a bearing upon this situation include: (1) slaughter relative to nonslaughter cattle, (2) market class and weight, (3) quality, (4) seasonality of marketings, and (5) procurement costs.—C. D. Phillips and James L. Pearson.

**Strawberry enterprise.**—Production of commercial strawberries in Kentucky is tending to move from the old production area in the western part of the state. Beginning with Warren county and including the 31 counties westward through the state, strawberry acreage decreased by 73 percent from 1949 to 1959. In the rest of the state strawberry acreage increased 55 percent from 1949 to 1959. The greatest increase was in the eastern and southeastern part of the state.

Kentucky farmers are utilizing the processing market more as a sales outlet. Prior to 1948 an insignificant amount of Kentucky strawberries went to the processing market. In most recent years, 30 to 50 percent of Kentucky strawberries moved to the processing market.—Willard H. Minton.

**The effects of forage—livestock combinations and systems on capital requirements.**—Most profitable programs for five farms which are representative of many others in Kentucky have been studied, with different amounts of available capital, to determine productivity of capital under optimum conditions and the effect of additional capital on the optimum grain-forage-livestock combination. The results of this have, in the main, verified what we already knew about capital productivity and use. At low capital levels crops for sale are important. As capital is increased, livestock enterprises which use it intensively are increased. This is often some system of hog production. Further increases bring capital—extensive livestock enter-

prises. Feeder calf production has been unimportant, if not nil, in all cases. High producing cows are necessary for dairying to compete successfully with other enterprises. Short supplies of family labor and unfavorable hiring opportunities cause the productivity of additional capital to decrease rapidly.—James F. Thompson.

**Part-time farming in western Kentucky.**—An evaluation of actual and potential resource use efficiency on part-time farms relative to that on full-time farms was made. A third group was designated as retirement farms and included in the analysis.

About one-third of the farms in the study area were designated as part-time and about one-fourth as retirement farms. Efficiency was measured by the value of output per dollar input. This ratio was less than one, on the average, for all three groups in 1955. It was highest on full-time farms and lowest on part-time farms. Under-employment of resources accounted for part of the differences in efficiency, but not all. Differences in level of technology used also accounted for part of the differences. Differences in the adaptation of enterprise combinations to available resources also accounted for part of the differences in efficiency. However, optimum resource use on all farms would still find full-time farms with the highest efficiency and part-time farms with the lowest. All three groups, on the average, could produce more than one dollar of output per dollar of input.—James F. Thompson.

**Understanding of cooperative business organization.**—Lack of understanding of the distinctive features of cooperative business organizations was found to be widespread among managers of the three largest groups of cooperatives in Kentucky, farm supply purchasing cooperatives, farm credit cooperatives (P.C.A.'s and F.L.B.A.'s), and Rural Electric Cooperatives. The "existing procedures . . . may reflect, in part, a lack of understanding of the relationship between patron members, directors, and hired management in a cooperative."

Three circulars reporting the detailed findings of a study of control processes in cooperatives were published. The study was unique in that plans for the study and early drafts of the manuscript were reviewed and coordinated with primary user organizations in an effort to stimulate interest and improve the study. In addition, a program of distribution use and evaluation was worked out with them. This involved a questionnaire which was filled out by directors and managerial personnel based on a reading of the manuscript and a review of the policies of the local associations, and was returned to the University. Research showed a high degree of readership and analysis of their own situations in the light of these findings.—Wendell C. Binkley and Eldon D. Smith.

**Estimates of government program effects in dark tobacco.**—A two-equation econometric model has been developed at the Kentucky Agricultural Experiment Station which permits the estimating of some of the effects of the government price support and acreage control program in the dark tobaccos. Estimates from this model in-



dicare that for a recent 5-year period the removal of price supports in the dark tobaccos, even with no change in volume of output, would have decreased market average prices by an average of about 8 cents per pound, or almost 25 percent. Dependence of the present market upon the support program is further indicated by the estimate that 80 percent of each million pounds of annual production in the dark tobaccos in excess of 1960 production will go to pool holdings.—R. W. Rudd and D. M. Shuffet.

**Reducing market risks in selling selected farm products.**—From a survey of 44 Union county farmers, it was found that all of them were aware of the risk of price fluctuation involved in selling hogs. Even with this awareness, however, over 95 percent of them indicated that they would prefer to accept such a risk in preference to making forward contracts to market their product. While interpretation of such a result is very complicated, and there are some quite subtle implications in interviews of this type, it is felt that this is significant. This would indicate that for operators of larger-scale farms, the sheer question of uncertainty may not rank very high in regard to choice of enterprise, time of marketing, or other decisions made in marketing farm products.

Also, an analysis has been made of the between-year variability of certain livestock enterprises. There is no clear-cut evidence that the industries characterized by contracting for future delivery on the part of producer, as in broilers and turkeys, have seen a significant decrease in between-year price fluctuations.—Paul R. Johnson.

**Work methods in pickle production.**—Cucumber production for pickles is a high-labor-demand enterprise requiring 200 to 275 man hours per acre for *picking* alone. The large amount of picking labor used raises the question of ways to reduce the labor input. Yield, growing practices and work methods are areas for consideration. Picking time varies inversely with yield. Yield is influenced by land productivity, planting practices, disease and weed control, and frequency of picking as well as method of picking.

A work methods study, in which yield was controlled by uniform fertility and frequency of picking by the same worker, indicated that *rowing of the vines* during the season and *rolling of the vine* at each picking result in the highest return to labor.—George B. Byers.

**Why consumers select specified foods.**—(In cooperation with Home Economics Department; see page 57.)

**Consumption of poultry meats in Kentucky.**—(In cooperation with Home Economics Department; see page 58.)

## AGRICULTURAL ENGINEERING

**Poultry house ventilation.**—A new system for poultry house ventilation was designed. The fan, located in the attic, draws air from the attic space down into the house. The air is forced against



a baffle board which deflects it across the ceiling in a thin sheet. The high velocity sheet of air across the ceiling mixes with air in the building and causes air movement and good distribution to all parts of the building. In the particular house tested, 30' x 50' in size with a 2,400 CFM fan, the air velocity across the floor averaged 65 feet per minute. Preliminary tests indicate that heat is also uniformly distributed throughout the building by this system.—B. F. Parker.

**Plastic greenhouse heating and ventilating.**—Emphasis, in the past, has been mostly upon the heating problem; however, attention has now turned to ventilation as well as heating. Air circulation is thought to increase yields of some crops grown in greenhouses. Air exchange is a means of removing excess moisture from the house.

Work has been done where the air exchange was provided by the blower on a duct furnace. A humidistat was used to control a damper which allowed the blower either to bring in fresh air or to recirculate inside air, depending upon the relative humidity within the house. The discharge vents for the heating system were located along the sides near ground level. This location was found to be undesirable, as it produced adverse effects on the tomato plants, even though it gave good heat distribution. The ducts were then relocated so as to discharge the heat downward into the center aisle from a clear plastic duct overhead. This arrangement has given improved results.—J. H. Casada.

**Preliminary studies in bulk curing tobacco.**—Bulk curing studies were made with both primed leaves and stalk-cut tobacco to determine the feasibility of this curing technique in burley tobacco. From general observations it was concluded that good quality burley tobacco can be obtained from bulk cures. However, before this technique can be effectively applied, proper air-flow rates and curing environments must be determined.—J. M. Bunn.

**Seedbed environment under plastic.**—Field experiments were conducted to study the effects of black plastic, clear plastic, and cotton mesh mulches on the temperature and moisture environment in a seedbed for tobacco. *Soil temperature at seed level:* (1) A clear plastic mulch resulted in highest average temperatures and high peak temperatures during sunlight hours. (2) A black plastic mulch, a cotton mesh mulch, and open soil with no mulch resulted in the same average temperatures; however, the temperatures under the black plastic mulch experienced less variation than under the other mulches or open soil. *Soil moisture:* A black plastic mulch resulted in a lower rate of soil drying than did the other mulches or open soil.—E. M. Smith.

**Curing frames and outside curing.**—Twenty-four curing frames, each 8' x 12' x 5' (2 standard rails) and designed to be handled with a fork lift, were used to cure tobacco outside the barn. The frames were loaded in the field as the tobacco was cut. A fork lift was used to lift the loaded frames and stack them on a sodded area adjacent

to the tobacco field. The frames were covered with 6 mil black polyethylene plastic to protect the tobacco from inclement weather during curing. Plastic side curtains were installed such that they could be raised or lowered like window shades. One acre of Burley 21 was cured in 1960. The frames can be handled with the fork lift with less labor than conventional methods. This work was done in cooperation with Mr. Julian Walden at his farm in Midway, Kentucky.—E. M. Smith.

**Labor use in harvesting and handling primed tobacco.**—Time and motion studies were conducted on Mr. Julian Walden's farm, Midway, Kentucky, using a priming machine for harvesting and three different methods of hanging the primed leaves for curing. A three-row priming machine required about 21 man hours of labor per acre for each priming taking three leaves per stalk. Two methods were used to house the primed leaves in a regular tobacco barn: (1) using a hand hoist to lift burlap sacks of primed leaves required 7.4 man hours per acre for the complete housing operation; (2) using a platform across the rails for the hanger to walk on and a hand hoist to lift sacks of tobacco to the platform required 9.1 man hours per acre; and (3) hanging the tobacco on frames mounted in large wagons required 13.4 man hours per acre. Thirty-eight man hours per acre were required to take the cured leaves down and tie them into hands.—E. M. Smith.

**Conveyor for stripping room.**—A conveyor to display cured stalks for more convenient stripping was designed, constructed, and installed in a stripping room on Mr. Julian Walden's farm, Midway, Kentucky. Data on the performance of this unit have not been analyzed at this time.—E. M. Smith.

**Progress in the development of a mechanical tobacco harvester.**—Recognizing the need to help alleviate the labor shortage in harvesting burley tobacco, the Agricultural Engineering Department in cooperation with Mr. Julian Walden, set out in January of 1960 to design, build and test a mechanical harvester. The machine is to stalk-cut burley tobacco which will have been primed twice, since cigarette manufacturers advocate this procedure for obtaining a product desirable for their use.

Only one man, the tractor driver, will be required to operate the machine, which is being designed and built in four main components: (1) a cutting unit; (2) a spearing unit; (3) a stalk spacing stick filling unit; and (4) a stick dispensing unit. The last three of these components were designed, built, and laboratory tested in 1960. The floating spear developed during 1959 was redesigned for use in the new machine.

When completed the harvester will mechanically deliver stalks of burley tobacco, evenly spaced on sticks, from the row to a means of transporting them to the curing facility.—S. W. Smith.



**Physical characteristics of tobacco plants.**—An investigation was made to determine the physical characteristics of tobacco plants, in order to describe the plants adequately, in terms which can be communicated universally.

Three aspects were studied: (1) the relationship existing between the diameter and height of the stalk or taper of the stalk; (2) the location of the leaves on the stalk; and (3) the strength properties of the stalk. The leaves were found to be arranged in the form of a spiral, making three revolutions around the stalk per eight leaves. The pitch of the spiral varies along the length of the stalk. The data are being analyzed to determine whether or not this spiral and the tapered shape of the stalk can be represented by mathematical equations. Data were taken pertaining to the strength properties of the stalk for the purpose of determining the basic stresses of the material.—J. H. Casada.

**A rigid frame for plastic greenhouses.**—A 30-foot glued plywood gusset rigid frame made from 2" x 2" dressed lumber was designed and tested. In comparison with more conventional framing, the designed frame uses less lumber and hence minimizes shading, is easier to erect, and offers a smooth interior and exterior surface which simplifies the stretching of plastic. A plastic greenhouse has been built using these frames, and its performance will be observed.—J. N. Walker.

## AGRONOMY

**Corn breeding.**—Major objectives of the work in progress are to improve dent corn hybrids through development of inbred lines possessing superior yielding and standing ability, resistance to diseases and insects, good grain quality, and reduced plant height. White and yellow endosperm types have received equal attention in the past, but greater effort will be expended on white corn in the future.

Emphasis is being placed on studies designed (1) to compare the relative efficiency of new breeding methods and procedures; (2) to determine the best methods for incorporating exotic germ plasm into adapted material for optimum utilization; and (3) to estimate the relative importance of various components involved in genotype environmental interactions.

AES 805, AES 809, and Ky 205W are new dent hybrids released in Kentucky in 1959. AES 805 and AES 809 are yellow hybrids developed and evaluated by cooperative effort among the north-central states, including Kentucky. These hybrids are similar to US 13 in maturity but are markedly superior to US 13 in yielding ability, resistance to root and stalk lodging, and low ear placement. Ky 205W is an early high-yielding white hybrid. It is considerably earlier than US 523W but is equal to this hybrid in resistance to root and stalk lodging. Ky 205W yields slightly less than US 523W. Ky 205W is similar in maturity to US 13.—F. A. Loeffel and J. F. Shane.

**Hybrid corn evaluation studies.**—Studies to evaluate the performance of genetic and plant breeding material from the corn program were conducted at eight locations in the state. In addition to these studies, experiments were conducted comparing dent corn hybrids which are commercially available in Kentucky as well as popcorn hybrids developed by the Kansas, Iowa, Indiana and Georgia Experiment Stations as a service to farmers of Kentucky. Progress in improving the performance of corn hybrids adapted to Kentucky conditions for yielding ability, standing ability, reduced ear height and disease resistance continues to be made as shown in the following tabulation:

|                                       | <i>Yield<br/>bu./A</i> | <i>Moist.<br/>%</i> | <i>Erect<br/>Plants<br/>%</i> | <i>Ear<br/>ht.<br/>ft.</i> | <i>Leaf<br/>Southern</i> | <i>Blight*<br/>Northern</i> |
|---------------------------------------|------------------------|---------------------|-------------------------------|----------------------------|--------------------------|-----------------------------|
| Hybrids released<br>before 1955 ..... | 94.7                   | 17.1                | 76.7                          | 3.9                        | 2.4                      | 2.4                         |
| Hybrids released<br>since 1955 .....  | 96.5                   | 16.8                | 88.4                          | 3.6                        | 2.2                      | 2.5                         |
| New Kentucky<br>Experimental Hybrids  | 103.3                  | 17.8                | 91.5                          | 3.8                        | 1.9                      | 2.1                         |

\* 1 = resistant, 5 = susceptible.

— F. A. Loeffel and J. F. Shane.

**Corn topping study.**—Two adapted corn hybrids, US 13 and AES 805, were topped at different positions and at different stages of growth in a replicated experiment conducted near Lexington in 1959. Grain yield was reduced by topping. Yields of treatments topped at the first, third, and fifth internodes above the ear were 91.8, 94.9, and 96.3 bushels, compared to the untopped check yield of 101.3 bushels. Yields of treatments topped four, six, and eight weeks after silking were 90.9, 95.1 and 97.0 bushels compared to the check yield of 101.3 bushels. Standing ability was not affected by topping in this study.— F. A. Loeffel and J. F. Shane.

**Silage evaluation of corn hybrids.**—Corn hybrids were evaluated for silage production at Lexington in replicated trials during a three-year period (1957-1959). Each hybrid was grown at 12,000 and 20,000 plants per acre. Silage yield and standing ability were not affected by plant population in two of the three years of the study. However, the averages for the three-year testing period indicate a slightly higher yield (5.2%) and slightly poorer standing ability for the 20,000 plant per acre planting rate. Silage produced at the 20,000 plant per acre level consistently had a somewhat lower feeding value, as measured by ear weight percentage composition, than the 12,000 plant level.

A hybrid selected for silage production should possess the same characteristics desired in a hybrid for grain production, i.e., high grain yield, good standing ability, and proper maturity. The performance of Ky 105 was markedly superior to the older hybrids (Ky 102, Ky 103 and US 13) and to the later hybrids (Dixie 22 and Dixie 29) for silage production.— F. A. Loeffel and J. F. Shane.



**Production capacity of corn hybrids of different maturity.**—Performance evaluation studies of corn hybrids of different maturities were conducted at Lexington in 1958 and 1959. The United States has been divided into 12 maturity zones by state and federal corn workers. The northern zone (100 maturity series) includes hybrids adapted to extreme northern United States and Canada. The 1200 maturity series hybrids are adapted to Florida and the Gulf Coast area. Hybrids representative of the 800 and 900 maturity zones are grown in Kentucky. Although the growing season in Kentucky is sufficiently long to mature 900 maturity hybrids, farmers in the state are growing predominantly earlier hybrids, 800 maturity. The results indicate that yield increased stepwise with later maturity hybrids from 37.6 bushels for the 100 maturity hybrids to 121.9 bushels for the 1000 maturity hybrids. Higher ear placement was associated with later hybrids and increased yielding ability. The yielding ability of hybrids considered too late for Kentucky conditions (1000 maturity) did not show a significant advantage in yield over full season adapted hybrids (900 maturity). The study indicated that the majority of the farmers in the state who are planting early season hybrids (800 maturity) are sacrificing considerable yield.

| Hybrid<br>Maturity | Acre Yield,<br>bu. | Ear Ht.<br>ft. | Silking<br>date | Moisture %<br>Sept. 13 |
|--------------------|--------------------|----------------|-----------------|------------------------|
| 100 .....          | 37.6               | 2.0            | June 29         | 13.7                   |
| 200 .....          | 52.5               | 2.0            | July 2          | 12.3                   |
| 400 .....          | 69.9               | 2.0            | July 5          | 18.2                   |
| 600 .....          | 79.0               | 2.5            | July 10         | 22.0                   |
| 700 .....          | 91.8               | 3.0            | July 12         | 24.4                   |
| 800 .....          | 105.3              | 3.2            | July 15         | 30.6                   |
| 900 .....          | 119.6              | 4.0            | July 19         | 32.3                   |
| 1000 .....         | 121.9              | 4.3            | July 26         | 37.2                   |

— F. A. Loeffel and J. F. Shane

**Tobacco that escapes virus infection.**—T. I. 245 is a variety of tobacco that has been found by others to escape virus infection unless heavily inoculated. The variety has white flowers, sets seeds poorly, has univalents in pollen mother cells at MI and AI, and micro-nuclei are present in tetrads. In the progeny of crosses with mosaic resistant burley tobacco (N), four degrees of fertility were observed: (1) normal seed set; (2) normal pod set with very few viable seeds; (3) normal pod set but no viable seeds; (4) blossoms drop even when hand self-pollinated. Group 2 pollen is viable to a limited extent when used on normal blossoms. The pollen of groups 3 and 4 showed variations when stained from 37 to 82 percent apparently normal pollen, but only 15 to 22 percent viability in germination tests. Setting was normal when Ky 16 was used as the pollen parent on 3 and 4 but reciprocal crosses failed to set any seed.—W. D. Valleau and P. N. Rao.

**An improved technique for determining the reaction of seedling plants to *Thielaviopsis basicola*.**—Preliminary tests to determine the

reaction of seedling plants of small-seeded forage legumes to *T. basicola* made in artificially infested greenhouse soil were somewhat variable and inconsistent. Tests using a medium of vermiculite and  $\frac{1}{3}$  strength Hoagland solution were consistently uniform and satisfactory. The inoculum, produced on 4- to 7-day old cultures on PDA, consisted of endoconidia and limited mycelium produced by 5 Petri-dish cultures in 1 L. of the solution. The vermiculite was saturated with this suspension at the time of seeding, and again 3 days later. The reaction of tobacco inoculated in this way was erratic, but when grown for 14 to 21 days and then similarly inoculated, the results were satisfactory. Disease ratings were made 14 to 30 days after inoculation. This technique has been used satisfactorily with one or more species of the following genera: *Glycine*, *Lespedeza*, *Lotus*, *Lupinus*, *Medicago*, *Melilotus*, *Phaseolus*, *Pisum*, *Trifolium*, *Vicia*, and *Vigna*. Four varieties of *lespedeza* (Auburn, Climax, Iowa #6, and Rowan) were highly susceptible to *T. basicola* as determined by the above described technique.—L. Henson and G. W. Stokes.

**Chromosome complements of  $F_1$  *Nicotiana tabacum* haploid ( $n=24$ ) x *N. Sylvestris* ( $n=12$ ) and haploid x *N. tomentosiformis* ( $n=12$ ) tobacco plants.**—Chromosome configurations on meiotic metaphase I plates were analyzed in 28  $F_1$  plants. Twelve bivalents (II) and 10 to 12 univalents (I) were observed. Zygotic selection favoring the eggs containing the 12 homologous chromosomes of the male parent must be present, since both groups of  $F_1$  plants show twelve paired chromosomes. In a previous study where genetic data from  $F_1$  haploid x diploid tobacco plants were reported (1959), the eggs could be deficient and still give rise to a viable embryo. Since the present study concerns the precursor subgenomes of *N. tabacum* as male parents, a high degree of interdependence between the subgenomes is likely.—G. W. Stokes.

**Burley tobacco varieties resistant to four diseases.**—The burley breeding program has long been directed toward developing satisfactory varieties with high resistance to black root rot, mosaic, wildfire and fusarium wilt. In 1960, as a result of selections of hybrids for high resistance to black root rot in controlled-temperature tanks, selection for fusarium resistance in the greenhouse and field and spraying plants in the plant bed and field with the wildfire organism, in order to select homozygous resistant lines, about 50 lines homozygous for resistance to the four diseases were selected. In the field the selected lines all appeared to be satisfactory burley, but further testing for yield and quality will be necessary before the best of them can be made available to the grower.—W. D. Valleau, G. W. Stokes, and C. C. Litton.

**Breeding for black shank resistance.**—In the past, selection for black shank resistant plants carrying the resistance factor from *N. longiflora* was done by dipping seedlings into a suspension of the black shank fungus and planting them in a pan of soil. This treatment was so severe that it usually resulted in death of susceptible



varieties and resistant varieties such as Burley 11A and 11B. What is needed is a test that will give results more comparable with those obtained under field conditions. This has apparently been accomplished by sowing about 15 seeds of each strain on vermiculite contained in plastic 1x4-inch centrifuge tubes with a drain hole in the bottom. Watering is done by dipping the tubes in Hoagland solution. After four weeks the tubes are dipped in a suspension of the black shank fungus in water, the inoculum entering through the hole in the bottom. Under these conditions but few plants of Ky 16 survive, Burley 37 survives well but has extensive root injury, while Beinhart 1002 has the best top growth and very little root injury. These results correspond nearly exactly with results obtained in a heavily infested field. Beinhart 2 has been crossed with burley lines resistant to four other diseases and with dark tobacco in an attempt to introduce this high black shank resistance into burley and dark tobaccos.—G. W. Stokes, C. C. Litton and W. D. Valleau.

**Comparison of quality of old varieties of burley with disease resistant varieties.**—In 1958, six old varieties of burley, supposedly farmers' selections from the original burley, were compared with Ky 16 and Burley 21 by two manufacturers, smoking tests by one and chemical analysis by the other. The purpose was to determine whether there were desirable characteristics in the old varieties that had been lost in the breeding program and should be re-introduced in future breeding. The best of "the old line varieties were about equal in quality to the present day standards." Three of the old varieties were distinctly inferior to Ky 16 and Burley 21 in quality. Smoking tests showed that Ky 16 was equal or superior to the old varieties. It appears that from the manufacturer's standpoint nothing has been lost in the development of two of the present standard varieties.—W. D. Valleau and G. W. Stokes.

**Tetraploid tobaccos not promising.**—By treating seedlings of Ky 16 and Burley 21 with colchicine, the chromosome number was doubled. These 96 chromosome varieties were grown in the field in comparison with the standard varieties. The tetraploids grew slowly, the leaves were rugose and small, and in general the plants showed no promise for commercial purposes.—G. W. Stokes and C. C. Litton.

**Spread of the tobacco etch virus.**—The tobacco etch virus has been present on the station farm for over 40 years but rarely more than scattered infected plants were seen. In 1960 the disease appeared at one end of a field and gradually spread with heavy infection for about 40 rows and light infection beyond that. Infected ground cherries (*Physalis* sp.) were found near the early outbreak but aphids (not yet identified) were rare on these weeds. Spread in the tobacco was evidently by *Myzus persicae*, the tobacco strain of the green peach aphid. The virus is a real threat to the tobacco industry now that an aphid which thrives on tobacco has become established.—W. D. Valleau.

**New dark tobacco varieties proving successful.**— Two new varieties of One Sucker tobacco designated OS-1 and OS-2 have been tested at the Princeton Station and with farmers in west Kentucky. Both are highly resistant to black root rot and mosaic. OS-1 is a narrow leaf variety desirable for certain foreign trade. OS-2 is a larger, wider leaf variety more like Ky 160. They will be introduced as Ky 163 and Ky 164, respectively. Because of the prevalence of black root rot, these varieties should prove of great value to the One Sucker growers. Three dark air-cured varieties, Dark Exp. 1, 2, and 3, are also highly resistant to black root rot and mosaic and should fill a place where Ky 151 is being damaged by black root rot. These will be introduced as Ky 155, Ky 157, and Ky 156, respectively.— W. D. Valleau, G. W. Stokes, and C. C. Litton.

**Evidence of so-called soil transmission of tobacco ring-spot virus to tobacco.**— Soil was collected from a field in which about 75 percent of the plants of Exp. 1 burley tobacco developed ring-spot in 1960. Of 256 burley plants set in this soil in flats, 4 developed ring-spot. These are the only tobacco plants that developed ring-spot in the greenhouse without inoculation in about 40 years, suggesting very strongly that infection occurred through the roots from some soil inhabiting vector.— W. D. Valleau.

**Frogeye.**— Field observations and inoculations with the frogeye fungus *Cercospora apii* Fres. indicate that the Brazilian tobacco variety Amarelinho has resistance to the fungus.— W. D. Valleau and E. M. Johnson.

**A population of self-fertile red clover necrotic spotting with a strain of bean yellow mosaic virus.**— A self-sterile plant of red clover of clone KyC39, known to be heterozygous dominant necrotic-spotting with bean yellow mosaic virus isolate 204-1, was pollinated with pollen from an autogamous self-fertile plant known to be recessive (mottling). The  $F_1$  and  $F_2$  or  $S_1$  populations segregated for reaction to the virus. A plant in the  $S_1$  population was selected that seems to be homozygous necrotic-spotting, self-fertile, and partially autogamous. Seventy plants from seed produced on this plant are necrotic-spotting. The population has been designated Ky BYMV Nec SF 1959.— S. Diachun and L. Henson.

**A comparative study of tomato and tobacco strains of tobacco mosaic virus with the plantago virus.**— Tomato strains of TMV and plantago virus which did not cause necrotic spotting on pinto and golden cluster wax beans had physical properties like the tobacco strains of TMV. They were not inactivated at 85°C for 10 minutes but all were inactivated at 90°C for 10 minutes. All strains showed some virus activity at a dilution of  $10^{-7}$  but none showed any virus activity at a dilution of  $10^{-8}$ .— E. M. Johnson.

**Dutch elm disease.**— Dutch elm disease was identified by isolation of the causal fungus from trees in Adair, Bourbon, Boyle, Fayette,



Mason and Shelby counties. Previously the disease has been identified from Caldwell, Campbell, Kenton, and McCracken counties.—R. A. Chapman and E. M. Johnson.

**Effect of the amount of light on the development of root-knot nematodes in tobacco.**—As the amount of light was increased (hours of light increased) the weight of roots of Burley 21 and the number of larvae of *Meloidogyne arenaria* increased. However, the number of larvae per gram of roots decreased. The numbers of larvae, both total and per gram of roots, of *M. hapla* decreased under the same conditions.—R. A. Chapman.

**Trends of populations of certain ectoparasitic plant nematodes in turf.**—Certain spiral nematodes (*Helicotylenchus spp.*) occurred in greatest number in bluegrass turf in late fall and in least number in spring and early summer. On the other hand, in the same turf, certain stylet nematodes (*Tylenchorhynchus spp.*) occurred in greatest number in spring and early summer and in least number in winter. Species of these genera were the most numerous plant parasitic nematodes in the turf.—R. A. Chapman.

**The production of homozygous diploids from haploids in *Nicotiana tabacum*.**—Diploids of *N. tabacum* vars. Ky 151 and Ky 16 were produced from haploids of these varieties by saturating buds in leaf axils with .2 percent colchicine and covering with a plastic bag. A few of the flowers borne by the treated tissue produced fertile pollen and set viable seed, indicating that the haploid chromosome set had been doubled.—G. W. Stokes, Raymond R. Stevens, and J. H. Smiley.

**Resistance to wildfire in relation to the gene-genome ratio in tobacco.**—An inverse relation exists between the number of genes for resistance to wildfire and the population of *Pseudomonas tabaci* within the 2x, 3x and 4x tobacco plants. The bacterial population was greatest in plants having no genes for resistance and least in plants having a gene-genome ratio of 2:2, 3:3, and 4:4 whereas the population was intermediate in plants with a gene-genome ratio of 1:2 and 2:4. With an increase in severity of symptoms there is an increase in recovery of bacteria.—G. W. Stokes and J. H. Smiley.

**Calcium deficiency—a symptom enhanced in mosaic resistant Monosomic H plants.**—It has been shown that the H chromosome of *Nicotiana tabacum* carries the *N. glutinosa* factor for mosaic resistance. In 1960, monosomic lines carrying the glutinose factor were grown in the field. Calcium deficiency was present in 35 of the 37 monosomic H plants, whereas none of the diplosomic H plants were affected.—C. C. Litton, P. N. Rao, and G. W. Stokes.

**Location of the *Nicotiana longiflora* wildfire resistance locus on chromosome A of Burley 21.**—Through the use of California monosomics in crosses with Burley 21, preliminary data indicate that the wildfire locus is located on chromosome A of the *N. tabacum* tomentosiformis subgenome.—G. W. Stokes.

**Red clover polycross progenies.**—Percent stands at the end of the third year in three experiments were noted. In the first of 2 experiments located in Woodford county 4 clones produced progenies which maintained greater stands than Kenland. Equal to Kenland were 62, and lower were 23. In the second experiment no progenies were superior, 9 were equal, and 75 were lower than Kenland.

In the third experiment located in Caldwell county, 4 progenies were superior and 20 were equal. None were lower in stand than Kenland. Only two of the total of 8 clones superior to Kenland at the two locations were identical, indicating a possible location x progeny interaction.—Norman L. Taylor and Gary Hicks, in cooperation with A.R.S.

**Evaluation of *Trifolium* species.**—A collection of 323 *Trifolium* introductions representing 86 species was established in the field in the spring of 1960 for taxonomic and agronomic evaluation. From a group of 58 species which flowered the number of species with the following flower colors were: 6, white; 23, pale pink or pink; 12, light red or red; 11, light purple or purple; and 6, yellow. Sixty-nine species appeared to be annuals and 17 species were either biennials or perennials.

Introductions within species were variable in degree of flowering and vegetative growth. Producing no flowers were 86 of the 323 introductions. Species making adequate growth to warrant further investigation for agronomic use numbered 101. Although 162 introductions produced seed, only 89 produced seed in sufficient quantities (0.5 to 1.0 grams per plant) for seed production to be economically feasible.—Norman L. Taylor and Gary W. Hicks, in cooperation with A.R.S.

**Tall fescue improvement.**—Polycross progenies and synthetics of inbred lines of tall fescue selected for improved palatability, polycross progenies of 73 well-grazed backcross progenies of perennial ryegrass—tall fescue hybrids x tall fescue 2, and Ky 31 variety were established in replicated sod plots and repeatedly grazed with cattle to study differences in palatability. Two new experimental varieties of tall fescue, designated Kentucky synthetic and 45-50 Outcross, and all polycross progenies of the backcross hybrids except one were significantly better grazed than Ky 31. Two polycross progenies of the backcross hybrids were significantly better grazed than 45-50 Outcross and 11 were better than Ky synthetic. In a test to study differences in palatability and percent consumption, the two experimental varieties, Ky synthetic and 45-50 Outcross, had 44 and 41 percent greater consumption respectively than Ky 31. Correlation analysis indicated a highly significant relationship ( $r = 0.75$ ) between percent consumption and palatability. Dry matter yields obtained from three different experiments showed no significant difference in yield between Ky 31 and the two experimental varieties, Ky synthetic and 45-50 Outcross. The two experimental varieties appear



to maintain a greener color than Ky 31 during periods of drought and in the winter months.

A palatability study was made on spaced plants of various genetic materials derived from  $F_1$  hybrids of annual ryegrass x tall fescue. Plants of the Ky 31 variety were used as a check. The nursery was repeatedly grazed with cattle during the summer. All entries were significantly better grazed than Ky 31 except progenies of  $F_1$  hybrids repeatedly grazed with cattle during the summer. All entries were of a 56 chromosome amphiploid and the progeny of an  $F_1$  hybrid crossed to the 56 chromosome amphiploid.

In an effort to obtain a population of fertile amphiploids, 42 plants were obtained in 1959 by treating  $F_1$  hybrids of annual ryegrass x tall fescue with colchicine. Twenty-two of these plants were observed to be fertile on the basis of anther dehiscence and were later determined to have  $2n = 56$  chromosomes, which is an exact double of the  $F_1$  hybrid. Approximately 1,000 progenies have been established from these 56 chromosome plants for seed increase and breeding behavior studies.

The  $F_2$  progeny of a 56 chromosome amphiploid of annual ryegrass x tall fescue outcrossed to two 70 chromosome amphiploids segregated into types of fescue and ryegrass foliage. A range of plant types varying from almost pure fescue to almost pure ryegrass was found by studying the  $F_2$  plants for certain morphological characters. The breeding behavior of the  $F_2$  plants indicates that by selection within this material, varieties can be developed that embody the good characteristics of both tall fescue and ryegrass.

First generation progenies of  $F_1$  hybrids of annual ryegrass x tall fescue backcrossed to annual ryegrass were studied for various morphological characters. Anther dehiscence indicated that approximately 50 percent of the plants were fertile. The population segregated into annual and perennial types during the first year of establishment. Approximately 11 percent were vigorous, perennial types, and all perennial types were found to be fertile.—Robert C. Buckner and Paul Burrus, Jr.

**Comparison of two newly bred strains of fescue and Kentucky synthetic orchard grass.**—(In cooperation with Dairy Science Department; see page 48.)

**Comparison of Kentucky bluegrass and 45-50 fescue for dairy heifers.**—(In cooperation with Dairy Science Department; see page 49.)

**Bluegrass breeding.**—The first and second generation progenies of Kentucky bluegrass selections from central Kentucky were compared in replicated sod plots for total dry matter yield and crabgrass invasion with lots of common Kentucky bluegrass from Canada and several bluegrass seed producing states. Nine of the 25 bluegrass selections are being increased for seed production on the basis of agronomic performance in previous years. The range in total dry matter production for these nine selections was from 4,411 to 5,208

pounds per acre; while the range in dry matter production for the commercial seed lots from Canada, N. Dak., Minn., Iowa, Mo., and Ky. was from 3,362 to 4,400 pounds per acre. The lowest yield was produced by the Canada seed lot and the highest yield by the lot from Minnesota. The plots were rated for crabgrass invasion twice during the summer. The nine selections of bluegrass being increased for seed production had an average invasion of 3.65 percent for all nine selections, while the average of all commercial lots was 26.76 percent.

During a severe epidemic of leaf diseases in June, all commercial seed lots were observed to have more disease than selections in the test.—Robert C. Buckner and Paul Burrus, Jr.

**Variety of burley tobacco x source of phosphorus x rate of phosphorus.**—Ky 10 and Burley 21 were fertilized at 45, 90, and 135 lb of  $P_2O_5$  per acre using calcium metaphosphate, diammonium phosphate and concentrated superphosphate. Main results show that (1) Ky 10 produced higher yields and higher value per 100 lb than Burley 21; (2) all rates gave significantly higher value per 100 lb than the control, but the 90 and 135 lb rates gave no increase in value over the 45 lb rate; and (3) source of phosphorus did not affect yield or value per 100 lb.—W. O. Atkinson and C. E. Bortner.

**Cigarette composition.**—The amount of tobacco used in cigarettes was less in August 1959 than in November 1958. This was accomplished by reducing the diameter of cigarettes and in some cases by increasing filter length. The average nicotine content was reduced from around 2.12% in 1958 to about 1.72% in 1959; one new brand appeared on the market with a nicotine content of about 1%. All of the six largest cigarette manufacturers were using reconstituted tobacco by the end of 1958; however, three companies were using small quantities ranging from trace amounts to 4%. The use of stem material increased, particularly by those companies using smaller amounts of reconstituted tobacco.—W. O. Atkinson and G. T. Webster.

**Effects of priming burley tobacco on chemical composition.**—Burley tobacco that was harvested by priming all leaves from the plant, a total of six primings approximately one week apart, was compared with burley that was stalk-cut in the usual way. Two years results show that priming increased total nitrogen from 3.16% to 3.60%, total alkaloids from 2.00% to 2.31%, total ash from 22.64% to 23.13% and decreased potassium from 4.59% to 4.34%. Alkalinity of the water-soluble ash, which is correlated with burning capacity, was decreased from 73.3 and 70.7; however, at this level such a difference would not be considered to have a measurable effect on burn.—W. O. Atkinson.

**Potassium uptake by roots.**—Tobacco plants (varieties Experimental 4 and Burley 21) were germinated and grown for four weeks in vermiculite watered with Hoagland's solution. The plants were



removed from the vermiculite, and the roots were washed and cut back to a length of one inch. The plants were then grown in aerated water culture until a vigorous root system developed (2 weeks). After an additional week in a potassium-free nutrient solution, the low-potassium roots were excised and placed in an aerated solution of 0.005 M KCl. Over a period of 4 hours roots of Burley 21 absorbed 25 to 30% more potassium than did the roots of Experimental 4. Under the influence of inhibitors which inhibit certain oxidative enzymes of plant roots, the K uptake of both varieties was inhibited, but the inhibition of Burley 21 uptake was greater, with the result that potassium uptake was the same for both varieties. These results suggest that the variability in potassium uptake by different varieties might be due to differences in respiratory pathways in the roots of the different varieties. Further inhibitor studies are being conducted with these and other varieties in an attempt to determine the cause of variation in potassium uptake by different varieties.—A. J. Hiatt.

**Translocation of minerals from the leafweb of burley tobacco during curing.**—A study was made of the translocation of certain minerals from the leafweb of four burley tobacco varieties (Ky 16, Ky 35, Burley 37, and Ky Experimental No. 4) grown at four locations in Kentucky in 1958. Two replicates of each variety were sampled at each of the four locations. Eight uniform pairs of plants from each replicate were selected for sampling. One from each pair comprised a sample for harvesting and barn curing in the usual manner. The other eight plants were harvested at the same time and this sample was dried immediately at 65° C. in a forced-air oven. Translocation during curing was determined by a comparison of the mineral content of the barn cured and the quick dried samples. Location had more effect on the rate of translocation and on the concentration of minerals than did the variety. However, translocation apparently was not affected by the level of concentration, but was more closely related to loss of dry weight during curing. Previous studies have indicated that the percent loss in dry weight during curing reflects the maturity of the tobacco. The greater variation in translocation between farms than between varieties may be attributed to greater differences in maturity at the various locations than varietal differences.

Phosphorus was the most mobile with losses from the leafweb of the varieties ranging from 20 to 25 percent. Potassium losses were slightly less, followed by magnesium and calcium.—A. M. Wallace and C. E. Bortner.

**Small grain improvement.**—Monon, a new soft, red winter wheat developed by the Purdue University Agricultural Experiment Station and the U. S. Department of Agriculture was increased and distributed to Kentucky Certified Seed Growers for 1960 fall seeding. Monon has been tested in Kentucky for five years and has given excellent performance. Monon combines resistance to hessian fly and leaf rust in a plant type slightly shorter and earlier than Knox.

Small grain variety tests were conducted at Lexington, Princeton, and Hopkinsville in cooperation with the Pennyrile Grain Improvement Association and Mr. Avril Oatts, and at Murray in cooperation with Murray State College. Average bu/A yields at the five locations for the recommended varieties were: *Wheat*—Monon, 45.4; Dual, 45.4; Todd, 43.8; Knox, 42.1; Vermillion, 41.0; and Vigo, 40.8. *Barley*—Dayton, 60.9; Hudson, 58.8; Kenate, 56.8; and Kenbar, 55.8. *Winter oats*—Bronco, 72.6; Forkeddeer, 71.0; Atlantic, 70.8; and Dubois, 69.5. *Spring oats*, Lexington location only—Mo. 0-205, 47.7; and Andrew, 38.8.

The value of the "bulk" breeding method for obtaining greater winterhardiness in oats is being investigated. In heterogeneous populations of homozygous material natural selection was effective for increasing percent survival in two of the three years. Two-year and three-year selection was not more effective than the best single year using the winter of 1959-60 as the test year.

Many winter oat selections have been made that appear more winter hardy than currently recommended varieties. These are now being crossed with varieties superior in lodging resistance to develop varieties which contain both of these important characteristics.

Seed increases of the oat variety C.I.7132 and the barley variety C.I.10541 were not genetically pure enough for release. Reselections of these varieties were made.—Verne C. Finkner.

**Grain sorghum.**—Nine grain sorghum varieties and twenty-one grain sorghum hybrids were grown at four locations in Kentucky in 1960. The test at Owensboro was completely destroyed by birds. The test at Franklin was discarded because of damage by water and weeks early in the season. Also discarded at the Franklin location was a plant-row spacing test, silage test, and a weed control test. Average yield for the Princeton test was 66.2 bushels per acre, compared with 89.5 bushels per acre for the Lexington test. Grain sorghum hybrids in the two tests had an average yield of 85.1 bushels per acre and the standard varieties 62.9 bushels per acre.—James F. Shane.

**Insect tests of grain sorghum.**—(In cooperation with Entomology and Botany Department; see page 53.)

**Sorghum sirup tests.**—Eleven varieties of sweet sorghum were tested at Quicksand, Kentucky. Five advanced experimental varieties were included, four of these being included in the Southeastern Cooperative Sorgho Variety Tests. Stalk samples were sent to Meridian, Mississippi, for juice analysis and processing. Forty experimental varieties were evaluated for disease resistance and maturity.—James F. Shane.

**Self diffusion of calcium 45 in soils.**—Calcium 45 was found to move as much as an inch in one month in a Manitou silt loam soil. The diffusion rate was relatively independent of calcium level in the soil. Diffusion at 20% and at 30% moisture was equal, but

diffusion at 10% moisture was somewhat slower. Increasing the soluble salt content of the soil appeared to increase the calcium movement at a low base saturation but not at a high base saturation. Diffusion coefficients for Calcium are on the order of  $2 \times 10^{-6}$  cm<sup>2</sup>/sec.—H. F. Massey and David L. Terry.

**The short-term phosphorus supplying power of soils.**—The effect of calcium saturation on phosphorus retention by Memphis soil and on phosphorus uptake by plants from soil-water suspensions was studied. Also the effects of acid washing soil and of aging the acid-washed soil were investigated.

Solution phosphorus increased with increased calcium saturation in untreated soil. Solution phosphorus decreased with increased calcium saturation to a minimum, then increased in acid-washed soils. Isotopically exchangeable phosphorus generally increased with increased calcium saturation.

The amount of phosphorus taken up by plants in a 24-hour period was not related directly to either the amount of solution or isotopically exchangeable phosphorus. Thus, it appears that neither of these parameters adequately describes the short-term phosphorus supplying power of the soil.

A definite change occurred in the phosphorus retaining properties of acid-washed soils during aging. There was a decrease in total solution phosphorus and percent P<sup>32</sup> in solution and a decrease in the amount of phosphorus the plants took up. An increase in solution calcium was also observed.—H. F. Massey and Howard Greer.

**Effect of source and placement of phosphorus on establishment of alfalfa.**—Alfalfa was seeded on Manitou silt loam using equipment suitable to control the placement of the seed and the fertilizer in bands. Three phosphate source materials, dicalcium phosphate, calcium metaphosphate, and concentrated superphosphate, were used in 7-inch row application rates of 30 pounds P<sub>2</sub>O<sub>5</sub> per acre. Two placements of the fertilizer were used, one banded 1"-1½" below the seed and the other on the ground surface in front of a cultipacker seed-covering attachment. Row applications of 0, 15, 30, 60, and 90 pounds P<sub>2</sub>O<sub>5</sub> per acre from concentrated superphosphate were used to obtain a response curve. The planting treatments were randomized over split replication treatments of 0, 45, and 90 pounds P<sub>2</sub>O<sub>5</sub> per acre from C.S.P. broadcast and disked into the top 3-4 inches of soil. The plots were split in 1960. One half of the original plots was topdressed with 120 pounds P<sub>2</sub>O<sub>5</sub> from concentrated superphosphate, with the remaining half being retained to measure the residual effect of the planting treatments. Uniform applications of 120 pounds K<sub>2</sub>O per acre were made at seeding and in the spring of 1960 when the plots were split. The seeding experiment was repeated in the fall of 1959 on Lowell silt loam soil, which has better internal drainage and is much higher in native soil phosphorus.

Dry matter yields from the Manitou experiment indicate little residual effect from the planting treatments except from the rates



of  $P_2O_5$  placed under the seed. The additional phosphate topdressed in 1960 increased dry matter yields on all planting treatments about 30%, with the same residual effect of the rates at seeding time showing significance. Plant population counts taken in the fall of 1960 showed no significance, with all plots having a plant population of near 5 plants per square foot.

The yield data from the Lowell experiment indicate that little beneficial effects can be expected from row placement of phosphorus on this type of soil. No significant difference in yields of dry matter was detected. Small differences in uptake of phosphorus were obtained in the first harvest due to the interaction of the broadcast, source and placement of the phosphorus. The number of plants per square foot decreased from 24.1 in November 1959 to 16.2 in April 1960, with 9.8 plants per square foot remaining in November 1960. The only difference in population due to treatment was in the November 1960 count, where the population was decreasing at a faster rate on the plots which had received 90 pounds  $P_2O_5$  per acre broadcast before seeding.—A. L. Hatfield.

**Source and granule size of potassium fertilizers for alfalfa.**—Alfalfa was established after sudangrass in 1948 on plots which had been treated with three potash-carrying materials. Muriate of potash  $-6 + 14$  mesh size with 100% of the K water soluble, potassium metaphosphate  $3/8'' + 4$  mesh size with 13% of the K water soluble, and potassium calcium pyrophosphate  $3/8'' + 4$  and  $-4 + 14$  mesh size with water soluble K of 7.5% and 5.9%, respectively, were used at rates of 60, 120, and 180 pounds  $K_2O$  per acre on the sudangrass. An additional 60 pounds  $K_2O$  per acre was topdressed on the plots which received the 60-pound rate in 1958 and 1959.

Dry matter differences in 1960 were evident in the third harvest only between the rates applied in 1958, the rates applied annually, and the annual rate of 60 pounds compared with the initial application of 180 pounds  $K_2O$  per acre. The total yield of dry matter for the 1960 season was essentially the same for all treatments as was the total amount of K removed with forage.—A. L. Hatfield.

**Effect of time of application of potassium fertilizers on the yield of dry matter and uptake of potassium by forage crops.**—Muriate of potash was applied at the rates of 180, 360, and 540 pounds  $K_2O$  per acre, both in the spring and at seeding time in the fall. The potash was disked into a plowed soil in the spring treatments, and the fall treatments were disked into the soil at seeding time. Alfalfa was seeded on Maury silt loam and ladino clover on Grenada silt loam.

Dry matter yields from Maury experiment show a significant increase with the rate of application of K made in June of 1958 but no difference for those made in September 1958. None of the other treatment variables was significant in the production of dry matter. The amount of K removed with the dry matter increased

with the amount of K applied in both the spring and fall treatments, with more being removed in the forage from the fall-treated plots.

Dry matter removed from the white clover experiment on Grenada in 1960 increased with the rates of K applied, both in the spring and fall of 1958, but with no difference between spring and fall treatment. The amount of K removed with the forage was essentially the same from all treatments.—A. L. Hatfield.

**Studies of biochemical mechanisms in the genus *Nicotiana*.—**Studies of the enzymes involved in respiration in tobacco leaves and tobacco roots were begun. Succinic dehydrogenase, an enzyme associated with plant mitochondria, was obtained in soluble form from tobacco leaves. The enzyme was purified by using a calcium phosphate gelcellulose chromatography column, and its properties were studied. The pH optimum for succinic dehydrogenase activity was found to be 7.4. The effect of succinate concentration and respiratory inhibitors on enzyme activity were determined. Because phosphate activates succinic dehydrogenase from animal tissues and because of the importance of phosphate in tobacco nutrition, the role of phosphate in the mechanism of succinic dehydrogenase from tobacco was studied. These studies indicated that phosphate does not play a role in the activity of succinic dehydrogenase from tobacco.—A. J. Hiatt.

**Soil classification.—**Four characterization samples representing three soil series were taken for the purpose of further research and study, especially pertaining to potassium fixation.

Coordination and cooperation with SCS on review of soil descriptions, work plans, soil legends, and field reviews are continuing processes.

The revision of "A Key to Kentucky Soils" was published.—D. F. Amos.

**Intereffects of management practices and environment on stands of red clover.—**Plants of six varieties of red clover which differ in persistence in Kentucky were subjected to treatments expected to exhaust carbohydrate reserves, i.e., frequent clipping or incubation in a dark chamber at several temperature and moisture levels. There were no significant differences in stand counts or number of days survival between varieties. When these values were adjusted to compensate for differences in size of the plants at the beginning of the stress then the most persistent variety in Kentucky ranked considerably higher than the unadapted varieties. It was inferred that persistence in Kentucky is enhanced by a slow rate of metabolism during periods when photosynthetic capacity is limited by high temperature, low moisture or frequent clipping.—W. A. Kendall.

**Physiological investigations of red clover.—**A survey was made of the rate of respiration of 30 entries of red clover using germinating seeds and leaf material at 24° and 34° C. Some differences in

respiration rates between entries were obtained with the germinating seeds which were apparently related to age of the seeds rather than to genetic differences. No differences between entries were obtained with the leaf material.—W. A. Kendall.

**Control of annual weeds in row-crops with herbicides.**—The number of annual weeds in soybean rows five weeks after treatment was reduced 95% or more and yield of beans was reduced little or none by the use of either of three experimental herbicides applied on the soil in a 13-inch band behind the planter presswheel at planting time. The herbicides and rates per acre, over-all basis, were: amiben, 4 pounds; 2,4-bis(isopropylamino)-6-methylmercapto-s-triazine (Prometryne), 2 pounds; and sodium pentachlorophenate, 15 pounds. The presently recommended herbicides sodium salt of NPA (Alanap 3) and CDAA (Randox) gave poorer control of weeds but did not harm the crops. The six other herbicides tested resulted either in weed control of less than 95% or reduced the yield of soybeans from that of the cultivated check, which produced 40 bushels per acre.

Annual weeds in corn rows at Lexington were reduced 90% or more and the crop injured little or none by the use of commercially available simazine 2 or 3 pounds and atrazine 2 or 3 pounds, or the experimental herbicide n-propyl di-n-propylthiolcarbamate (R-1607) 4 or 6 pounds per acre (over-all rates), applied in 13-inch bands on the soil behind the planter presswheel at planting time. The seven other herbicides tested resulted either in poorer weed control, injury to the crop, or both. Granular formulations where tried were about as effective as the corresponding liquid or wettable powder formulations.

In similar tests on corn in the Ohio River overflow bottoms of Henderson county heavy infestations of giant foxtail were controlled 90% or more by the commercially available herbicides simazine and atrazine at over-all rates of 3 pounds, CDAA + trichlorobenzyl chloride (Randox-T) at 3 + 7.5 pounds, or by the experimental herbicide fenac at 2 pounds incorporated lightly with the soil at application time. None of them reduced the stand of corn and only fenac affected growth with 20% of plants being stunted or epinastic.

Early weeds in burley tobacco were controlled very well and the growth of the crop reduced very little by the use of either of the experimental herbicides EPTC (granular formulation), 3 pounds; trietazine, 3 pounds; or 2,6-dichlorobenzonitrile (Casoron), 3 pounds per acre. They were applied broadcast over the tobacco 9 days after transplanting. The EPTC and Casoron were applied just before cultivation and the trietazine just after. Effects of these herbicides on smoking quality of tobacco are not yet evaluated.—J. F. Freeman.

**Dormancy of buried weed seed.**—New seeds of Johnson grass and of wild sorghum mixed with soil in clay pots which were buried 6 inches deep in field soil in August 1956 were recovered in June 1960. Germination tests resulted in 88% viability of the Johnson grass and 95% of the wild sorghum seed after burial for 4 years. These



data help to explain the difficulty of eradicating either of these grass weeds on infested land where seeds have been buried by plowing or by overflow soil deposits.— J. F. Freeman.

**Soybeans.**— In row spacing tests at Henderson neither early maturing Clark, nor late maturing Hood varieties produced significantly different yields of beans from rows 24 or 36 inches apart than from conventionally spaced 40-inch rows.— J. F. Freeman.

**Introduction of new plants.**— Approximately 170 packets of seeds or plants of new species, varieties, or lines of field and horticultural crops and of ornamentals were brought to the Kentucky Agricultural Experiment Station in 1960 from Federal plant introduction stations. These items were or will be studied to determine their possible usefulness in Kentucky.— E. N. Ferguson.

**Comparison of Maury and Hagerstown soil series.**— Both chemical and clay mineralogical comparisons of three Maury series profiles and two Hagerstown series profiles point up the difficulty in distinguishing between the two series as they occur in Central Kentucky. Heretofore, differentiation has been based upon phosphate level, Maury soils being derived from high-grade phosphatic limestone whereas Hagerstown soils are characteristically low in phosphorus. Determinations of Truog P for the five profiles revealed that two Maury and one Hagerstown series profiles were low in soluble P, whereas one profile of each series was high in that constituent. Thus, field differentiation of the series on the basis of P quick tests is difficult. Other chemical determinations, i.e. pH, % O.M., C.E.C., exch. Ca, Mg, K and Na, result in rather similar data for profiles of the two series. They are also quite similar clay mineralogically, both containing approximately equal amounts of kaolinite, illite, vermiculite and montmorillonite and lesser amounts of quartz as discrete minerals along with interstratified 2:1 lattice components. Characteristically, the 14°A member identified as vermiculite is more abundant and also more difficultly collapsible in the surface horizons. Interlayer Al is thought to play an important role in the 14°A spacing stability.— T. B. Hutcheson, Jr.

**Curves for explaining effects of liming on pH.**— Titration curves which may be used as bases for liming recommendations, as well as in the interpretation of both practical and experimental response to liming, have been developed for some 25 important Kentucky soil series. Correlation of these curves with soil-lime equilibrium responses in the laboratory appears very good. However, final field testing is a necessary step in the perfection of such a procedure.— S. J. Ross, Jr., and T. B. Hutcheson, Jr.

**Alfalfa varieties.**— In 1960, alfalfa variety trials were conducted at three locations. As in previous years, there was very little difference in the production of the recommended varieties (Vernal, Narragansett, DuPuits, Buffalo, Williamsburg, Atlantic and Ranger).

The only deviation from this performance was that Ranger and Atlantic appeared to be slightly inferior to the other varieties in the western part of the state.—W. H. Stroube and G. W. Hicks.

**Sweet clover varieties.**—The varieties Evergreen, Goldtop, and W-7 remained vegetative longer than other varieties tested. In 1960 the varieties produced the following yields in tons of dry matter per acre: Evergreen, 3.21; W-7, 2.60; Goldtop, 2.51; Common White, 2.41; Madrid, 1.40; Common Yellow, 1.32; and Arctic 0.96.—W. H. Stroube and G. W. Hicks.

**Orchard grass seed lots.**—Of 29 lots of orchard grass seed collected from a like number of commercial seed outlets in Kentucky, eight produced unsatisfactory stands. Five of the lots gave from 2% to 40% stands and three from 41% to 60% stands. The remaining 21 lots were satisfactory. Most of the unsatisfactory lots were of foreign origin, had no regulatory tag, or had an indication of low germination on the regulatory tag.—W. H. Stroube and G. W. Hicks.

**Classes of Clair timothy.**—Seedlings of lots of Clair timothy seed equivalent to the breeders, foundation, and registered seed classes were observed during 1960. These observations indicated that there was no difference between classes of Clair either alone or with alfalfa and that all classes showed the same relative superiority over commercial timothy as has been demonstrated in previous years.—W. H. Stroube and G. W. Hicks.

**Effects of cutting frequency on Clair timothy.**—Summaries of data collected during the first and second productive years showed that: (1) in both 1959 and 1960, 3 cuttings per season resulted in higher yields of seeded species and lower yields of weeds than did 4, 5, 6, or 7 cuttings per season, but hay quality was poor the first harvest of the 3-cut system; (2) all plots were more weedy in 1960 than in 1959 except those permitted to mature seed and those containing Ladino clover; (3) in both years corm weights were highest on plants which were permitted to approach maturity before the first cutting; (4) in 1960 corm weights were lowest on plants which had been cut at 2- or 3-week intervals prior to the sampling date.—J. K. Evans, T. H. Taylor, and W. C. Templeton, Jr.

**Legume establishment and maintenance in grass sod.**—Additional data were obtained in 1960 from renovation experiments begun in the spring of 1957 on old bluegrass sod growing on Eden Hill land in Owen county. Results showed that: (1) alfalfa has been the most persistent and highest producing legume studied; (2) red and Ladino white clover stands were practically gone the second productive year (1959) and completely gone in 1960; (3) trefoil stands decreased more slowly than the clovers but were not satisfactory by the end of the 3rd productive year; (4) production from annual lespedeza seeded each spring into the old sod with a grain drill has varied widely from year to year; and (5) herbage production of undisturbed sod receiv-

ing 150 pounds of N per acre was lower than that of the established stands of alfalfa-bluegrass.—T. H. Taylor, J. K. Evans, and W. C. Templeton, Jr.

**Forage species adaptation on sloping Eden Hill land.**—Various combinations of forage species were established in Owen county in the spring of 1955 and observed through the growing season of 1960. Observations and data for the 1960 growing season showed that: (1) alfalfa stands are still quite satisfactory and high yielding; (2) trefoil stands were reduced in 1960 under stands present in 1959; (3) lespedeza seeded in fescue was no higher yielding than the old stands of trefoil-fescue; (4) alfalfa-fescue ranged in production over the 5-year period from 6,005 to 8,534 pounds of dry matter per acre, while lespedeza-fescue ranged from 1,469 to 4,000 pounds.—T. H. Taylor, W. C. Templeton, Jr., and J. K. Evans.

**Potassium uptake studies.**—Differences among burley tobacco varieties in their ability to take up potassium have been demonstrated in the field (Tob. Sci. V. 4, 1960). A procedure is being developed to study the uptake of potassium and other nutrients using small plants produced under controlled day length and temperature. The seed is planted directly on vermiculite in glass tubes 9.8 cm long and 25 mm outside diameter. The top of the tube is flared slightly and the lower end constricted to a diameter of 4 mm. The tubes are treated with the desired nutrients by lowering the tubes into the nutrient solution and leaving them until the surface of the vermiculite is moist (5 to 10 minutes depending on size of plants). The excess nutrient solution is allowed to drain from the tubes and the tubes placed in the growth chambers. By carefully packing the vermiculite into the tubes each will hold approximately the same amount of solution. Plants are harvested after 4 to 5 weeks of growth. Varieties used to test the procedure were ones that show differences in potassium uptake in the field. The differences among varieties in the concentration of potassium in the plant were similar to those obtained from field tests.

This procedure will be used to screen new breeding material for its ability to take up nutrients. Through this procedure much time can be gained in the testing program by eliminating low uptake material long before it would be ready for normal field testing.—J. L. Hamilton and C. E. Bortner.

**Calcium deficiency.**—When grown in the same field, certain varieties of burley tobacco show symptoms of calcium deficiency while others do not. The severity of the symptoms varies among years. Usually the symptoms first appear about the time the plants start to bud, with no apparent damage to the harvested leaves which had formed at an earlier date. The deficiency symptoms may appear in fields where the soils are high in exchangeable calcium. The concentration of calcium was found to be as high in composite samples of the leaves from affected plants as from unaffected plants. The



affected parts of the leaves have not been analyzed separately. Two varieties, one that readily shows deficiency symptoms in the field (Burley 21) and one that only rarely shows calcium deficiency symptoms (Ky 16), were grown in a modified Hoagland's nutrient solution low in calcium, using the small-plant technique described in the potassium study above. Both varieties showed calcium deficiency symptoms in solution containing less than 20 ppm calcium and there was no difference in the concentration of calcium in the plants between the two varieties. From this limited amount of data it appears that calcium deficiency in burley tobacco on Kentucky soils is not due to a limited uptake of calcium, but may be due to other factors related to calcium nutrition in the plant.—J. L. Hamilton and C. E. Bortner.

**Alfalfa-variety-mixture management study.**—Data were obtained the second productive year (1960) of this experiment. These data indicated that: (1) no differences in dry matter yield occurred among the varieties Du Puits, Narragansett, and Rhizoma, when cut 3, 4, 5, or 6 times during the growing season; (2) hay yields were the same on stands of alfalfa-orchardgrass and alfalfa grown alone, but weed content was higher in the alfalfa grown alone; (3) hay yields were higher under the 4-cut system than under the 3-, 5-, or 6-cut systems; (4) alfalfa yields were the same under the 3- and 4-cut systems and considerably higher than under the 5- and 6-cut systems; (5) the grass component in the alfalfa-orchardgrass stands contributed more to the hay yield in 1960 than in 1959; and (6) stands of alfalfa deteriorated on the 5- and 6-cut managements.—T. H. Taylor, J. K. Evans, and W. C. Templeton, Jr.

## ANIMAL HUSBANDRY

**Consumer preference study in pork.**—A survey was conducted at the 1960 Kentucky State Fair in which people who registered at the Meats Exhibit were asked to complete a questionnaire pertaining to pork cuts. About 4,500 registrations were obtained; however, questionnaires from those under the age of 21 were not used in the tabulations. The questions are listed below with the total number of answers in each category inserted:

1. Please check the weight range of pork cuts that you prefer.

### *Weight range (pounds)*

|                      |          |        |         |        |
|----------------------|----------|--------|---------|--------|
| A. Ham .....         | Under 11 | (751)  | 11 - 13 | (595)  |
|                      | 13 - 15  | (599)  | 15 - 17 | (368)  |
| B. Picnic .....      | Under 4  | (300)  | 4 - 6   | (1221) |
|                      | 6 - 8    | (671)  | Above 8 | (139)  |
| C. Boston Butt ..... | Under 3  | (492)  |         |        |
|                      | 3 - 5    | (1272) | 5 - 7   | (452)  |
|                      | Above 7  | (94)   |         |        |

2. Please check one of the following as your choice for sliced bacon.  
A. Extra fat (40) B. Medium fat (963)  
C. Extra lean (1280)
3. Please check your preference for size of pork chops.  
A. Extra large (328) B. Medium (1822) C. Small (151).
4. Please check your preference for marbling (fat within lean) in pork chops.  
A. Well marbled (280) B. Slightly marbled (1201) C. Not marbled at all (464) D. Doesn't matter (363).

— W. Y. Varney, R. A. Field and J. D. Kemp.

**A photometric method of determining rancidity in pork fat.—**

A simple, fast colorimetric procedure was developed for determining lard rancidity. The procedure is as follows: Add 300 lambda of lard and 5 ml. of isopropanol to 10 ml. of 0.8019 M KOH-isopropanol solution and shake. Heat in a 70°C. water bath for 6 minutes. Read the optical density at 385 millimicrons on a colorimeter using the heated KOH-isopropanol solution as a reagent blank. The optical density at 385 millimicrons is termed the Ranco value. The following highly significant correlations were found between Ranco values and other rancidity tests: peroxide numbers,  $r = 0.918 \pm .120$ ; iodine numbers,  $r = -0.996 \pm .026$ ; TBA values,  $r = 0.934 \pm .108$ ; and colony counts of Ramsey's microbiological method,  $r = 0.970 \pm .073$ . Ranco values increased with increasing concentrations of heptaldehyde from  $0.7 \times 10^{-4}$  to  $14 \times 10^{-4}$ M. Since Ranco values increased with lard oxidation, it was concluded that carbonyl compounds are responsible for the Ranco test.— C. B. Ramsey, J. D. Kemp, and R. B. Grainger.

**Quick aging of hams.—** Four temperature-humidity controlled cabinets were constructed and are being used at temperatures of 80, 90, 100, and 110°F., respectively, with a relative humidity of approximately 60%. Thirty-two hams were dry-cured and smoked. Eight were placed in each box. Chemical change in the fat was being determined by the use of iodine numbers, peroxide numbers, and free fatty acid values. All increased with all treatments during aging. Average ham shrinkage figures determined at weekly intervals, after 10 weeks aging, were 23.8, 23.3, 23.9, and 27.9%, respectively, for the four temperatures. Hams were removed for palatability testing after each month of aging. After two months the results are only preliminary and inconclusive. The tests are being continued.— J. D. Kemp and G. C. Skelley.

**Keeping quality and shrinkage of pork from hogs of different degrees of fatness.—**Hams from 56 Hampshire hogs slaughtered in the fall of 1959 and spring of 1960 were dry-cured, smoked, and aged for 6 months at 65°F., with a relative humidity of approximately 55-60%. Hams were divided into 4 fatness groups on the basis of average backfat thickness. Group 1 was from hogs with average backfat thickness under 3.5 cm.; group 2, 3.5 to 3.9 cm.; group 3, 3.9-4.4

cm.; and group 4, 4.5 cm. or above. Most of the hogs were in groups 1 and 2. Shrinkage increased significantly throughout aging but was not significantly different among groups after 6 months. The average shrinkage was 30.1, 30.2, 29.1 and 24.2% respectively for the four groups, indicating a trend toward less shrinkage in the fatter hams. Peroxide numbers and free fatty acid values increased significantly during aging in all groups, with no significant differences among groups. Iodine numbers decreased slightly during aging with no significant differences among groups.—J. D. Kemp, G. C. Skelley, and W. Y. Varney.

**Carcass traits and palatability scores of meat from grass and milk-fed calves.**—The significance of data from 27 calves from Hereford and Red Poll cows and a high-gaining and a low-gaining bull are indicated below. Approximately  $\frac{1}{2}$  of each group were creep fed. Carcass yield, significant at the 0.01 level in favor of the Red Poll cross; carcass weight per day of age, ( $P < 0.01$ ) in favor of the Red Poll cross; percent separable fat, ( $P < 0.05$ ) in favor of the Red Poll cross; percent bone, ( $P < 0.01$ ) for Herefords over Red Poll and ( $P < 0.05$ ) for non-creep over creep fed; percent ribeye moisture, ( $P < 0.01$ ) for Red Poll cross over Hereford and ( $P < 0.01$ ) for non-creep over creep fed. There were no significant differences among any of the groups for carcass grade, marbling score, fat thickness over the ribeye, ribeye area per hundred pounds of carcass, percent ribeye, percent total separable lean, percent ether extract, and palatability scores for flavor, juiciness, and tenderness.—W. Y. Varney and J. D. Kemp.

**Production costs, processing costs, carcass characteristics and consumer acceptance of light weight hogs.**—Data from 216 Hampshire hogs indicated that hogs weighing 160 pounds required significantly less feed per hundred pounds of gain, at a lower price per pound of gain, than hogs weighing 200 pounds. However, the heavier hogs made faster gains. Packers estimated that processing costs were 20 percent greater for hogs slaughtered under 175 pounds. Retailers preferred smaller cuts than those being merchandised. Significantly more consumers considered cuts from the heavier hogs too fat. No significant differences in tenderness were shown by the Warner-Bratzler shear machine or taste panel, and no significant difference in flavor was indicated by the panel. Cooking losses from loin roasts from the heavier hogs were significantly higher. The wholesale value per hundred pounds live weight was greater for the light weight hogs.—Ray A. Field, W. Y. Varney, and James D. Kemp.

**Carcass evaluation of lambs from selected crosses.**—Lambs from three feed-lot tested Southdown rams and similar Western type ewes were evaluated for carcass characteristics when they reached approximately 85 pounds live weight. On a standard feeding test Group I ram gained 0.40 lb per day; Group II, 0.31 lb per day, and Group III, 0.23 lb per day. Average age of slaughter for the single lambs was 150, 164, and 186 days, respectively, and for the twin lambs 234,



206, and 202 days, respectively. Average carcass weight per day of age was 0.304, 0.275 and 0.259 lb, respectively, for singles; and 0.193, 0.216 and 0.226 lb, respectively, for twins, with a combined average of 0.253, 0.243 and 0.244 lb, respectively. All lambs graded choice or prime. Percents fat, bone, and lean for the three groups were 31.78, 13.13, and 53.69 for Group I; 32.93, 13.41, and 52.57 for Group II; and 34.51, 12.94, and 51.38 for Group III, showing that the faster growing rams sired slightly leaner carcasses. This was not reflected, however, in size of rib eye and fat thickness over rib eye.—J. D. Kemp, W. Y. Varney, P. G. Woolfolk.

**Teasing ewes before the breeding season.**—The presence of rams near ewes or in the breeding flock has been shown to affect breeding behavior. Through cooperation with two farm flock owners vasectomized rams were placed in breeding flocks two weeks before fertile rams were introduced. Flock A consisted of 98 ewes of various ages. Flock B consisted of approximately 100 yearling ewes and 200 mature ewes. One-half of the ewes in each group were teased before breeding. Lambing results were as follows:

|                           | Flock A |        | Flock B          |             |                |             |
|---------------------------|---------|--------|------------------|-------------|----------------|-------------|
|                           | Control | Teased | Yearling Control | Ewes Teased | Mature Control | Ewes Teased |
| Av. lambing date .....    | Jan. 17 | Jan. 9 | Feb. 22          | Feb. 21     | Feb. 4         | Feb. 11     |
| Percent ewes lambing      |         |        |                  |             |                |             |
| first 28 days .....       | 73      | 72     | 30               | 23          | 59             | 38          |
| Percent ewes lambing .... | 88      | 86     | 88               | 86          | 97             | 86          |
| Lambing rate .....        | 1.67    | 1.38   | 1.50             | 1.30        | 1.73           | 1.67        |

Teasing had no significant effect upon lambing performance. The only consistent difference was in lambing rate, which was lower for the teased ewes. These data indicate no advantage in lambing performance from teasing ewes for a two-week period before fertile rams are placed in the flock.—R. H. Dutt and J. S. Evans.

**Influence of elevated ambient temperature on fertility and early embryo survival in ewes.**—In studies with crossbred ewes on the effect of high ambient temperature upon fertility and early embryo loss, it was found that when the ewes were placed in a room at 90°F, R.H. 60%, on the twelfth day of the cycle before breeding, fertility rate was significantly lowered (92.6% vs. 51.9%). Abnormal ova were increased from 3.4% in the controls to 44.2% in the heated ewes. Embryo loss was estimated to be 91.7% vs. 4.0% for controls. Both the percentage of abnormal ova and early embryo loss have been found to be higher early in the breeding season when the percent of ewes conceiving is low. In ewes exposed to similar ambient conditions eight days post-breeding, the estimated embryo loss was 15.5%, and 85% of the ewes lambed. In later studies ewes have been placed in the heated room at time of breeding, at 1 day, 3 days, and 5 days post-breeding. Zero, 20, 35, and 40% of the ewes in these respective groups lambed. Fertilization rate was 69.2% in the group placed in the heat at time of breeding. Fertilization rate for the other experimental groups was estimated to be 96.4% from slaughtered control ewes. These

results suggest that the critical period for heat damage appears to be during fertilization and while the ovum is in the oviduct. As the embryo becomes older and after it enters the uterus, it is less susceptible to the damaging effects of high ambient temperature.—R. H. Dutt.

**Histological changes in testes from rams exposed to elevated temperature.**—Sections prepared from rams' testes after exposure to 90°F for one week showed extreme disorganization of the germinal epithelium. Debris and clumps of cells filled the lumen of the seminiferous tubules, and evidence of degeneration of all stages of spermatogenesis was apparent. At this time no marked change was found in semen characteristics. This is thought to be the result of mature sperm cells stored in the epididymis which appear to be less affected by heat. However, fertility had dropped from 70 to 20 percent. Two weeks later the tubules were emptied of degenerative masses, and spermatogonia showed mitotic activity. At this time sperm concentration had decreased and percent of abnormal cells had increased. Six weeks after treatment fully-developed sperm were found, and all tubules showed normal spermatogenic activity, but sperm concentration was at its lowest level. Ten weeks after treatment semen characteristics and fertility were at the pretreatment level. Short periods of exposure to high ambient temperature may produce temporary sterility in rams. Heat damage to spermatogenesis imposes a recovery period which may last as long as 8 to 10 weeks.—E. C. Simpson and R. H. Dutt.

**Synchronizing estrus in ewes by feeding an orally-active progestin.**—Provera (6 methyl 17 acetoxypregesterone) was fed to ewes starting at various stages in the estrous cycle for a period of 14 days. In a preliminary study 50 mg daily given by capsule was found to inhibit estrous activity. Thirty-six ewes were included in the study. The hormone was mixed in ground corn, which was fed so that 50 mg was available daily to each ewe. None of the ewes came into estrus while on treatment. Seventy-two percent came into estrus within 3 days after end of treatment and 83% within 8 days after end of treatment. All ewes that came into estrus were bred and one-half were slaughtered for fertility data. The ovulation rate was 1.1 and 70 percent of the ova were fertilized. Of the remaining ewes which had been bred, 42 percent lambed. Subsequent estrous cycles of ewes which did not become pregnant were apparently not affected by the treatment, since they were of normal duration. The presence of active corpora lutea on the ovaries of ewes not showing heat within 8 days post-treatment is evidence that ovulation had occurred without heat behavior. The treatment was quite effective in controlling time of estrus, but this did not insure uniform time of lambing, since less than half (42%) of the ewes conceived from breeding at the first post-treatment heat.—E. C. Simpson and R. H. Dutt.

**Selective breeding for earlier lambing in purebred Southdown sheep.**—During the 1958 and 1959 breeding seasons the ewe flock was divided into three groups in which early-born yearling rams were

used as sires each year. Three weekly semen collections were taken from the rams during July for laboratory study. Seven yearling rams were also used as sires in individual breeding groups of 20 to 25 crossbred ewes. Semen from these rams was also studied. Simple correlation coefficients between average lambing date of breeding groups and semen characteristics of sires are as follows:

|                           | Southdown<br>Ewes (6 sires) | Crossbred<br>Ewes (7 sires) |
|---------------------------|-----------------------------|-----------------------------|
| Semen volume .....        | -.92                        | .02                         |
| Abnormal cells, % .....   | .40                         | .67                         |
| Motile cells, % .....     | -.49                        | -.51                        |
| Sperm concentration ..... | -.11                        | -.40                        |

There was some association between semen characteristics in July and subsequent breeding performance of rams. Information from more rams is necessary before any conclusions can be made. The average interval between date of first breeding and conception was 30 days. An average of nearly three services to conception was required per ewe. One effective way of getting earlier lambs is to shorten the interval between first breeding and time of conception. Studies with crossbred ewes show that high ambient temperature lowers fertility and increases early embryo loss, both of which may result in a longer interval between onset of the breeding season and successful pregnancy.—R. H. Dutt, P. G. Woolfolk, and R. J. Ericsson.

**Shearing of Hampshire-cross Montana and Suffolk-cross Texas ewes prior to breeding, and their comparative performance.**—A trial begun in 1958 to study the effect of shearing ewes just prior to breeding on their subsequent performance was repeated in 1959-60. Forty-six Suffolk-cross 2-year-old Texas ewes, 47 Hampshire-cross 2-year-old Montana ewes, and 31 aged Hampshire-cross Montana ewes, all of which had been in the 1958-59 trial, were used. In these three groups, ewes sheared in the 1958-59 trial served as unsheared controls. In addition, a group of 37 Hampshire-cross yearling Montana ewes were added. Seventeen of these ewes were randomly selected and sheared. All ewes were sheared on August 3, 1959 and turned with Southdown rams on August 10. Ewes were allotted into one-ram groups according to shearing treatment, type, and age of ewe. Toward the end of the breeding season all groups were run together with a Hampshire ram as a clean-up ram. All rams were sheared prior to the breeding season.

One sheared and one unsheared Texas ewe, 4 unsheared 2-year-old Montana ewes, and one unsheared yearling Montana ewe failed to lamb. Shearing failed to increase the earliness of lambing of Texas ewes, but in the Montana groups sheared ewes lambed earlier (3 days to 3 weeks). In the two groups where shearing had the least effect on lambing date (Texas and 2-year-old Montana ewes) it did shorten the lambing season slightly. In the other two sheared groups, shearing simply moved up the onset of lambing. Lambing percentage was higher in two sheared groups (2-year-old and aged Montana ewes) and resulted in a larger number of lambs raised. In the other



two groups no difference in lambing percentage resulted, but fewer lambs were raised in the sheared yearling Montana ewe group, which was the earliest group of Montana ewes to lamb. Lambs lost in this group were either dead at birth or died soon after birth. In five of the eight possible comparisons of 56-day lamb weights, results were slightly in favor of shearing. Total fleece weights in three of four comparisons were lower for ewes sheared twice. In no case were spring fleece weights from twice-sheared ewes equal to those of their controls. Texas ewes lambed 16 days earlier than comparable 2-year-old Montana ewes but produced slightly fewer lambs. Also, lambs from Texas ewes weighed 3.3 pounds (singles) and 1.7 pounds (twins) less at 56 days of age than lambs from the 2-year-old Montana ewes.—P. G. Woolfolk and L. H. Boyd.

**Creep feeding and early weaning of lambs.**—Four lots of either 23 or 24 pregnant crossbred ewes each were assigned to a trial designed to determine the value of creep feeding simple versus complex grain mixtures to lambs and the feasibility of early weaning of lambs. Lambs raised were treated as follows: Lot 1—control, no creep; Lot 2—simple creep mixture, 87.5 percent cracked corn, 10.0 percent soybean meal, and 2.5 percent Aureomycin Crumbles; Lot 3—complex creep mixture, 55.0 percent cracked corn, 30.0 percent soybean meal, 5.0 percent sugar, 5.0 percent alfalfa meal, 2.5 percent Aureomycin Crumbles, 1.5 percent bonemeal and 1.0 percent salt; Lot 4—same as 3 except that lambs were weaned at an average age of 61 days and continued on feed in drylot on the same grain mixture. Ewes in all lots were fed the same ration of alfalfa hay and corn until April 8, when they were put on bluegrass pastures.

Single lambs' weights at 28 days of age averaged 24.9, 24.4, 25.4, and 23.8 pounds; twins averaged 18.4, 17.5, 19.3, and 20.1 pounds, respectively, for the four lots. At 56 days, singles averaged 39.3, 39.5, 45.2, and 42.6 pounds; twins, 28.7, 29.2, 35.3, and 36.8 pounds, respectively, for the four lots. At 100 days, singles averaged 58.6, 64.0, 69.9, and 69.2 pounds; twins averaged 48.3, 51.0, 57.2, and 59.8 pounds, respectively, for the four lots. Creep feed intake per 100 pounds of gain was 93.6, 113.9, and 198.8 pounds and the feed cost per 100 pounds of gain, \$2.97, \$4.53, and \$7.91, respectively, for Lots 2, 3, and 4.

Differences among 56-day weights of twin lambs were significant at the one-percent level. The differences between Lots 1 and 3, Lots 1 and 4, Lots 2 and 3, and Lots 2 and 4 were significant at the one-percent level. Differences among 100-day weights of twin lambs were significant at the one-percent level. The differences between Lots 1 and 3, and Lots 1 and 4 were significant at the one-percent level and that between Lots 2 and 4 significant at the five-percent level. This work is being continued.—P. G. Woolfolk, G. C. Peterson, and L. H. Boyd.

**Silage rations for pregnant-lactating ewes.**—Final results of a silage trial on which a preliminary report has been made are given here.

Six lots of pregnant crossbred ewes were fed in drylot beginning December 17 in a comparison of corn silage and three alfalfa-brome-grass silages preserved with either 150 pounds of cracked corn, 8 pounds of sodium bisulfite, or 1 pound of flavored antioxidant, per ton of green forage. A standard ration of alfalfa hay and corn served as a control. Ewes in all silage lots were fed alfalfa hay at an average rate of 0.99 pound per ewe daily plus all the silage they would consume. All lots had access to bonemeal and phenothiazine-trace mineralized salt. Lambs were creep-fed a mixture consisting of 87 percent cracked corn, 12 percent linseed meal pellets, and 1 percent Aureomycin Crumbles from February 4 until March 26, when ewes and lambs of all lots were placed together on bluegrass pasture.

Based on 100-day lamb weights, corn-preserved and sodium bisulfite-preserved silages were significantly superior to the flavored antioxidant-preserved silage and corn silage. Withholding approximately 60 percent of the normal grain allowance of ewes on corn-preserved silage resulted in significantly lower lamb gains. Lambs appeared to be thriftier in the control lot and consumed nearly twice as much creep feed as the next highest lot. However, gains among the lots were not in direct relationship to creep feed consumption. Ewes on corn silage maintained their own liveweight quite well but evidently did not milk as well as the control or two of the grass silage lots. At the present time further study is being conducted on corn-preserved and wilted silage in an effort to find better means of utilizing grass silage in our forage programs. In this experiment, consumption of silage was not high enough to bring total dry matter consumption up to the level of that in the alfalfa hay control lot. Efforts are being made to alleviate this difficulty with grass silage rations for ewes.—P. G. Woolfolk and L. H. Boyd.

**The effect of high levels of calcium in the gestation rations of bred gilts confined to concrete.**—Twelve Hampshire gilts were randomly allotted to three experimental rations. Four gilts were individually fed each ration treatment to study the effect of embryonic and early postnatal nutrition on the occurrence of parakeratosis. A standard gestation ration containing 0.65% calcium and 40 ppm of zinc served as the basal. Treatment 2 consisted of the basal plus 0.84% calcium, and treatment 3 consisted of treatment 2 plus 27 ppm of zinc. The gilts were confined individually on concrete floors and were hand fed their respective rations for the entire gestation period.

The feeding of these ration treatments did not result in any pigs developing parakeratosis. It was observed that the gilts fed a level of calcium, 1.50%, in excess of the recommended level, 0.60%, farrowed stronger pigs and had a greater number of pigs surviving at 3 weeks. It was also observed that the gilts receiving supplemental zinc seemed to milk better than the gilts on either treatment 1 or treatment 2.

These findings indicate that bred gilts raised in confinement should receive a level of calcium higher than the recommended level of 0.60%. This trial did not reveal any relationship between embry-

onic and early postnatal nutrition and the occurrence of parakeratosis in baby pigs.—C. E. Barnhart and J. C. Robertson.

**Balbo rye pasture and legume silage versus a drylot for bred sows.**—Forty mature sows were randomly allotted to four different treatments at breeding. The treatments were: (1) sows confined to concrete feeding floor and fed 6 pounds of gestation ration per day; (2) Balbo rye pasture plus 2 pounds of the gestation ration per day; (3) Balbo rye pasture plus 4 pounds of the gestation ration per day; and (4) self-fed alfalfa silage plus 3 pounds of the gestation ration per day (sows confined to a concrete floor). All sows were hand-fed the complete gestation ration twice daily. Automatic waterers were used to water all lots of sows.

Results of this trial further substantiate previous trials with Balbo rye pasture. Mature sows apparently can produce excellent litters with a very minimum of feed if good rye pasture is available. The size of the sow and her condition will largely determine the amount of concentrate to feed, assuming the pasture is ample. On the basis of this trial the 2-pound level appears to be quite adequate and satisfactory. The rye pasture had a carrying capacity of about 5 sows per acre. The performance of the sows receiving alfalfa silage was equally as good as that of the other lots of sows. These sows were self-fed the silage and consumed an average of 14-15 pounds of silage per day. Where silage is available, it appears to be an excellent brood-sow feed.—C. E. Barnhart and Marvin Selke.

**Hampshire swine herd performance record.**—In 1951 a swine performance record project was started. Birth and 56-day weights were taken on each litter farrowed. At weaning, one gilt and one barrow from each of these litters were placed on concrete and self-fed a complete mixed ration until they reached 200 pounds. These test pigs were then slaughtered and detailed carcass measurements were made. Future breeding stock selections were made on the basis of this information. The type of individual was also considered in making selections for the breeding herd.

Performance of the 33 litters tested in 1959 was: average pigs farrowed, 10.7; average birth wt, 3.14 lb; average number pigs weaned, 9.43; average 56-day wt, 38.7 lb; average daily gain, 1.53 lb; average feed per lb gain, 3.46 lb; average backfat, 1.37 in.; average length, 29.4 in.; average % lean cuts carcass, 57.6; average loin eye, 4.53 sq. in.; percent no. 1 carcasses, 98.24.—C. E. Barnhart, J. D. Kemp, and W. Y. Varney.

**Virginiamycin, a new antibiotic, for growing swine.**—Forty pure-bred Hampshire pigs, averaging 31 pounds, were allotted to two replicate lots of five pigs each, to each of 4 ration treatments. All lots of pigs were adequately housed in the same manner. Each pen was thoroughly cleaned and steamed before the experiment was started. The pigs were all treated for internal and external parasites, vaccinated for hog cholera and erysipelas, and male pigs were castrated



before they were placed on feed. All groups were self-fed their respective ration and had access to an automatic waterer. Pens were kept adequately clean at all times. The basal ration was a 16% corn-soybean mixture with adequate levels of vitamins and minerals. The different ration treatments were: (1) basal, (2) basal + 40g chlortetracycline per ton, (3) basal + 20g virginiamycin per ton, and (4) basal + 40 g virginiamycin per ton. The pigs were all fed 69 days. Results were as follows:

|                                    | Ration Treatments |       |       |                   |
|------------------------------------|-------------------|-------|-------|-------------------|
|                                    | 1                 | 2     | 3     | 4                 |
| No. replicate lots/treatment ..... | 2                 | 2     | 2     | 2                 |
| No. pigs/replicate .....           | 5                 | 5     | 5     | 5                 |
| Days on feed .....                 | 69                | 69    | 69    | 69                |
| Av. initial wt, lb .....           | 31.3              | 31.0  | 30.7  | 30.9              |
| Av. final wt, lb .....             | 112.0             | 118.3 | 121.8 | 132.8             |
| Av. daily gain, lb .....           | 1.16              | 1.26  | 1.32  | 1.48 <sup>a</sup> |
| Av. feed/lb gain, lb. ....         | 3.18              | 3.12  | 2.92  | 2.87              |
| Av. daily feed intake, lb .....    | 3.74              | 3.94  | 3.85  | 4.24              |

<sup>a</sup> Difference between basal and basal + 40 gms. virginiamycin highly significant ( $P > 0.01$ ), between basal + 40 gms. chlortetracycline and basal + 40 gms. virginiamycin significant ( $P > 0.05$ ).

— C. E. Barnhart and J. C. Robertson

**Roughage-concentrate ratio and relationship of calcium to fat-depressed cellulose digestion by sheep.**—Levels of corn oil (0, 2, 4, and 8%) were related to roughage:concentrate ratio (80:20, 65:35 and 50:50) and level of added calcium (2.5g, 5.0g, and 10.0g per head per day) in two sets of 3x4 factorial metabolism trials with four mature wethers on each treatment. Cellulose digestibility was depressed by 8% corn oil at all roughage concentrate ratios and by 4% corn oil at the 80:20 ratio. The magnitude of decrease in apparent digestibility of protein, cellulose, dry matter, and calcium was quantitatively related to level of calcium intake.—R. B. Grainger, R. Anggorodi, and J. W. Stroud.

**Effects of enzymes on nutrient digestion by wethers.**—Two digestion trials consisting of 10-day preliminary periods and 10-day collection periods were conducted with four mature wethers on each treatment. A basal ration consisting of cottonseed hulls, 50; isolated soybean protein, 9.9; corn oil, 2.0; corn starch 35.8; bonemeal, 1.6; trace mineralized salt, 0.5; magnesium sulfate, 0.2 percent; and adequate vitamins A and D to meet NRC requirements for 80-pound wethers was used in both trials. In the first trial, the addition of a multiple enzyme preparation resulted in a highly significant ( $P < 0.01$ ) improvement in dry matter, cellulose, and crude protein digestibilities, but not nitrogen retention. In the second trial adding the multiple enzyme preparation was tested along with additions of equivalent activities of gumase, amalyase, protease, or a combination of all three. The multiple enzyme improved digestibility but not significantly. All other treatments significantly increased cellulose digestibility. Gumase, amylase or the addition of three enzymes significantly increased dry matter digestibility. Only the combination of three enzymes signifi-

cantly improved protein digestibility. All treatments except gumase addition improved nitrogen balance.—R. B. Grainger and J. W. Stroud.

**Neutral fat as a source of energy for fattening wethers.**—Thirty-two wethers lambs were used in fattening and digestibility experiments to study the potentials of waste fat as an energy source in pelleted rations for lambs. The control pellets (I) contained 50 percent bluegrass hay, 6.7 percent soybean meal, and 43.3 percent yellow corn. The experimental pellets (II) contained 70 percent bluegrass hay, 8.9 percent soybean meal, 15.6 percent yellow corn, and 5.6 percent waste tallow. Adequate trace mineralized salt and vitamins A and D were added to both rations. Although gross energy intakes were similar, a group of eight 67-pound wethers fed ration I for 84 days gained significantly faster (.497 vs. .408 lb per day) than a similar group fed ration II. Digestibility of the rations was determined by using eight wethers on each ration during an 18-day preliminary period followed by a 7-day collection period. The digestible energy content of the control ration was significantly greater than the digestible energy of the ration containing waste fat. Thus reduced energy digestion appears to account for the poorer feed-lot gains of the lambs fed ration II.—J. W. Stroud and R. B. Grainger.

**Effect of supplemental fat, erythromycin, and trace minerals on the value of corncob rations for fattening lambs.**—Forty crossbred Montana wethers were divided into eight groups for a 2x2x2 factorial study of the effects of synthetic alfalfa ash, erythromycin, and fat additions to a lamb fattening ration based on corncob roughage. Rate of gain, feed efficiency, and digestibility of dry matter, crude protein, and crude fiber were studied during a 14-day preliminary trial and a 70-day treatment period. Digestibility was determined by the chromic oxide technique during 5-day periods starting on the seventh day of the preliminary period and on the eighth, thirtieth, and fiftieth days of the treatment period. Either trace minerals or fat significantly reduced gain. The erythromycin treatment resulted in a slight nonsignificant decrease in gain. After adjusting for differences in dry matter digestibility during the preliminary period by covariance analysis, none of the observed differences in dry matter and protein digestibility were statistically significant. In the case of crude fiber digestibility, interactions between period and treatment and between fat and erythromycin were significant. Erythromycin depressed the digestibility of crude fiber on non-fat rations, but enhanced crude fiber digestion on rations which contained fat.—R. B. Grainger and J. W. Stroud.

**Effect of Hygromycin A in lamb fattening and digestion studies.**—Four lots of five wether lambs each were fed a pelleted basal ration containing 50% ground corncobs plus hydrol, red dog flour, ground corn, soybean meal, NaCl, CaCO<sub>3</sub>, KI, CoSO<sub>4</sub> and vitamins A and

D during a 45-day fattening trial. Four similar lots were fed the basal ration with Hygromycin A added at the rate of 5mg per pound of feed. Hygromycin significantly ( $P < 0.05$ ) improved rate of gain (.35 vs. .27 lb per day) and feed efficiency (12.48 vs 14.30 lb of feed per lb of gain) and increased feed intake 13 percent. Digestibility of the two rations and the influence of limited (700g per day) and self-feeding (1754g per day) on digestibility were studied in a 37-day 2x2 factorial trial involving 16 lambs. Average dry matter digestion coefficients were: self-fed basal, 63.0; self-fed Hygromycin A, 65.4; limited-fed basal 65.6; and limited-fed Hygromycin A, 70.3. The improvement in digestibility resulting from either limiting the amount of ration fed or adding Hygromycin A was highly significant ( $P < 0.01$ ).—R. B. Grainger and J. W. Stroud.

**Vitamin A, trace minerals, mixed supplements, and alfalfa hay as supplements to fattening rations for beef steers.**—This experiment was conducted to determine what effect vitamin A, trace minerals, mixed supplements, alfalfa hay, and a combination of mixed supplements and alfalfa hay would have on a fattening ration of corn silage, ground shelled corn, and soybean meal. Vitamin A was added to the ration at the rate of 5,600 I.U. per steer daily. The trace mineral mixture was added to the ration in quantities sufficient to supply the requirement for trace minerals in addition to those in the feed. The mixed supplement, composed of equal parts of soybean meal, linseed meal, and distillers dried grains with solubles, replaced soybean meal in the basal ration on a protein equivalent basis. Alfalfa hay was fed at the rate of 2 pounds per steer daily and replaced one-half pound of soybean meal. The combination of mixed supplement and alfalfa hay was also fed on a protein equivalent basis. The increases in average daily gain over the control ration for the various treatments were as follows: vitamin A, 0.22 pound; trace minerals, 0.12 pound; mixed supplement, 0.05 pound and alfalfa hay, 0.23 pound. The alfalfa hay in the combination of alfalfa hay and mixed supplement was responsible for an increase of 0.24 pound daily while the mixed supplement in the combination was responsible for an increase of only 0.06 pound daily.—N. W. Bradley.

**Effect of zinc, bacitracin on steers being fattened in drylot.**—Sixty yearling Hereford steers in average feeder flesh were equally divided into six lots of ten steers each. All lots of steers were fed a fattening ration of ground shelled corn, corn silage, and soybean meal for the first 64 days of the experiment. During the last 88 days of the experiment alfalfa hay replaced corn silage in the above ration. The purpose of this experiment was to determine the effect of zinc bacitracin and a combination of zinc bacitracin and stilbestrol on the feed-lot performance of fattening steers. The treatments and average daily gains for the six lots of steers were: control, 2.20; 35 mg zinc bacitracin, 2.16; 70 mg zinc bacitracin, 2.22; 36 mg stilbestrol implant, 2.35; 36 mg stilbestrol implant plus 35 mg zinc bacitracin, 2.43; 36 mg stilbestrol im-



plant plus 70 mg zinc bacitracin, 2.41. Although silbestrol implants improved both rate of gain and feed efficiency, zinc bacitracin appeared to have no effect.—N. W. Bradley.

**Pelleted, flaked, and ground corn for beef steers.**—Forty yearling Hereford steers were divided into four lots of 10 steers each on the basis of weight. Treatments were as follows: lot 1, ground corn and distillers dried grains with solubles (DDG/S); lot 2, ground corn and pelleted DDG/S; lot 3, pelleted corn and pelleted DDG/S; lot 4, flaked corn and pelleted DDG/S. The roughage component of the fattening ration was corn silage. For a 129-day feeding period, the average daily gains were 2.09, 1.95, 2.31, and 2.36 pounds for lots 1 through 4, respectively. There was no significant difference in any of the treatments because of the large variation among steers within lots. The average feed required for each 100 pounds of gain for lots 1 through 4 was 1,032, 1,064, 916, and 930 pounds, respectively. Carcass grade was not affected by any of the treatments. Eight additional steers were used to study the digestibility of the four rations. The digestion study included four trials during the course of which each steer consumed each ration. A total collection of feces and urine was made. There was a decrease in digestible crude fiber and a slight increase in nitrogen retention for the ration containing pelleted corn. The ration containing flaked corn had an increase in dry matter digestibility, digestible crude protein, fiber, NFE, energy, and TDN, although only the digestibility of NFE was significantly ( $P > .05$ ) increased.—N. W. Bradley and D. W. Arnett.

**Effect of fat and urea on fattening rations for beef steers.**—The results of an experiment involving pelleted rations containing fat, urea and fat plus urea compared with a basal fattening ration of ground shelled corn, ground corncobs, molasses, and soybean meal were reported last year. There was a significant decrease in rate of gain for steers fed the ration containing fat plus urea when compared with the basal ration. During the second experiment pelleted rations containing fat and urea, fat and urea plus calcium, and fat and urea plus lysine were compared with a basal fattening ration of ground shelled corn, ground corncobs, molasses, and urea. For a 155-day feeding period average daily gains and feed required per 100 pounds of gain were basal ration, 2.27 and 1064; fat and urea, 2.06 and 1031; fat and urea plus calcium, 2.03 and 1027; fat and urea plus lysine, 2.00 and 1022. It is apparent that neither the high level of calcium nor the supplemental lysine prevented the decrease in rate of gain when fat and urea were combined.—B. M. Jones, Jr., N. W. Bradley, and R. B. Grainger.

**Trifluomeprazine implants for beef steers being finished in drylot.**—In the fall of 1959, 50 fleshy yearling steers which had grazed bluegrass pasture during the summer were equally divided into 5 different lots of 10 steers each. These steers were used to study the effect of different levels of trifluomeprazine implants on steers re-

ceiving a fattening ration in drylot. None of the three levels of tranquilizer increased rate of gain significantly. The 20mg level of tranquilizer increased rate of gain by 0.17 pound per steer daily, 40mg had no effect on rate of gain and the 80mg level slightly decreased gain. It is interesting to note that steers receiving the 20mg level of tranquilizer implants used their feed much more efficiently than the control steers.—N. W. Bradley.

**Reserpine for growing calves.**—Results of a previous experiment in which different levels of reserpine were fed to fattening cattle indicated that 2mg daily was the best level to use. The purpose of the experiment reported here was to determine whether reserpine administered at the 2mg level would improve the performance of calves fed wintering type rations.

Fifty-two steer calves were divided into four equal lots of 13 steers each. Lots 1 and 2 were fed a ration composed of bluegrass hay, soybean meal, and 3.5 pounds of corn daily. Lots 3 and 4 received the same ration except the corn was doubled in order to promote faster gains. In addition, the calves in lots 2 and 4 were given 2mg of reserpine per head each day. The four lots of calves were on the above treatments for 151 days during the winter of 1959-1960. Under the conditions of this study rates of gain were practically the same regardless of reserpine treatment. Doubling the amount of corn increased daily rate of gain from 1.05 pounds to 1.42 pounds.—N. W. Bradley and B. M. Jones.

**Performance and carcass characteristics of Hereford and Red Poll x Hereford calves slaughtered at weaning.**—A study of the effect of sire performance and breed of dam on fat calf production was continued during the past year. As a result of unexplained abortions only 12 Hereford calves and 15 Red Poll x Hereford calves were dropped during the calving season. The crossbred calves were 11 pounds heavier at birth and about 115 pounds heavier at weaning. Crossbred calves also averaged one-third of a grade higher on both estimated slaughter grade and U. S. carcass grade. As usual, Hereford calves were scored slightly higher on feeder grade. This is the third year in which Red Poll x Hereford calves have outperformed the Hereford calves. They have also yielded carcasses which were equal or superior to those from Hereford calves.—N. W. Bradley, W. P. Garrigus, J. D. Kemp, and W. Y. Varney.

**Creep feeding calves.**—Three years' work on the effect of creep feeding calves on preweaning performance has been completed. A total of 105 calves for the three-year period is included in this summary. Each year the calves were divided into two groups according to breed and sire. The creep feed was composed of corn, barley, oats, and a protein supplement the first year. During the past two years the creep feed was a simple mixture of 9 parts of ground shelled corn and 1 part of soybean meal. A small increase in rate of gain by the creep-fed calves amounted to 13 pounds more per calf during the

season. When calf gains were valued at \$0.25 per pound, the creep-fed calves were worth \$3.25 more per head. Each calf ate an average of 523 pounds of creep feed. If creep feed is valued at 2.4 cents a pound, the creep feed cost \$12.79 per head. Since the increased gain, as a result of creep feeding, was worth only \$3.25, the practice of creeping feeding was a losing proposition to the extent of \$9.54 per calf.—N. W. Bradley and W. P. Garrigus.

## ANIMAL PATHOLOGY

**Ascarid control in the horse.**—Both critical tests and field studies on low dosage rates of piperazine indicated that 10mg piperazine base per pound body weight via stomach tube has a marked to complete removal action on the horse ascarid. Only the piperazine-carbon disulfide complex was uniformly 100 percent effective, while in comparison, polymethylenepiperazine, piperazine citrate and piperazine adipate were somewhat less effective at 10mg base/lb.—J. H. Drudge, S. E. Leland, Jr., E. T. Lyons, and Zae N. Wyant.

**Strongyle control in the horse.**—Combination of phenothiazine with piperazine in single therapeutic doses was synergistic against strongyles, particularly the large strongyles, *Strongylus vulgaris* and *S. edentatus*. Reducing the dosage levels of both components in the combination to 50 percent of the regular therapeutic doses of each did not seriously impair the activity.

Low-level administration of dithiazanine iodide compared favorably with phenothiazine for strongyle control. Both resulted in nearly complete inhibition of larval development of both large and small strongyles during treatment.

For ponies, phenothiazine at the regular therapeutic dose rate of 2.5/cwt was too low for effective removal even of the small strongyles. In comparison, dithiazanine iodide at 10gm/cwt was 90 percent effective.—J. H. Drudge, S. E. Leland, Jr., E. T. Lyons, and G. W. Elam.

**Bot control in the horse.**—Storage of the piperazine-carbon disulfide complex for a prolonged period (two years) impairs its efficacy against bots but not against the ascarid or strongyles. More extensive testing indicated that the complex at the rate of 7.5mg/cwt removes an average of 89 and 81 percent of the second and third instar *G. intestinalis*, respectively, and 100 and 78 percent of the second and third instar *G. nasalis*, respectively.

The organic phosphate, Bayer 13/59 (Dylox), at 30mg/kg and above was nearly 100 percent effective against both stages of both species of bots.—J. H. Drudge, S. E. Leland, Jr., E. T. Lyons, Z. N. Wyant, and G. W. Elam.

**Gastro-intestinal parasite control in sheep.**—The second year's observations on infections of *Haemonchus contortus* in small flocks maintained on pasture indicated that the free-choice consumption of phenothiazine-salt (1:9) was much more effective against control strain



A than against the resistant strain B. The average weekly fecal egg counts for the year for all animals on the strain A treated lot was only one-sixth that observed for those on strain B treated lot. The organic phosphate, Ruelene, in monthly drenches was more effective in controlling stomach worms in lambs than phenothiazine. However, the 10 Ruelene-treated lamb's average daily gain was only 0.03 lb, compared with the 0.17 lb for the 10 phenothiazine-treated lambs and 0.10 lb for the 10 untreated controls.

Dithiazanine iodide/salt mixture (1:50) *ad lib* exerted some prophylactic action in the control of the gastro-intestinal nematodes in lambs on pasture. Diethylcarbamazine citrate drenches at 7.5mg and 15.0mg base/kg in sheep produced only a limited reduction of post-treatment fecal egg counts. However, combination of these dosages with therapeutic doses of phenothiazine resulted in additive or synergistic action and the egg count reduction exceeded 90 percent. Subcutaneous administration of Diethylcarbamazine citrate at 15mg/base/kg was associated with a marked (84 percent) reduction of post-treatment egg count.—J. H. Drudge, S. E. Leland, Jr., E. T. Lyons, Z. N. Wyant, and G. W. Elam.

**Total serum protein, blood and plasma volume, and electrophoretic serum fractionation in *Trichostrongylus axei* infected and uninfected lambs.**—This study progressively reported earlier, is now complete. Twelve crossbred lambs (3½ to 5½ months old at inoculation), raised helminth-free, were used in the study. Ten of these lambs were inoculated with *T. axei* larvae and two served as helminth-free controls. Marked deviations from the preinfection or control values for serum proteins and blood and plasma volumes were obtained in lambs infected with 250,000 or more larvae. Serum protein alterations were (1) hypoproteinemia as measured in grams per 100 ml of serum and total grams of circulating protein, and (2) hypoalbuminemia with an increase in the gamma globulins, all of which were evident in percentage composition, grams per 100 ml of serum, and grams of total circulating component. Blood and plasma volume alterations in infected animals were the development of polycythemic hypovolemia which, if the animal survived, developed into an oligocythemic hypovolemia. At a point in the transition from the former to the latter condition, a state of simple hypovolemia existed.—S. E. Leland, Jr., J. H. Drudge, and Z. N. Wyant.

**Studies on the infectivity of *T. axei*.**—A recent equine study suggested vitamin A deficiency might have some role in *T. axei* infection. Thus, rats, which are naturally refractive to *T. axei* infection, were rendered visibly A deficient with an appropriate diet and challenged to varying numbers of infective *T. axei* larvae. Patency as indicated by detection of eggs in the feces was not established.—S. E. Leland, Jr., J. H. Drudge, and G. W. Elam.

**Salmonella contamination of animal feeds.**—A survey of animal feeds and their ingredients for contamination with Salmonellas re-

vealed that approximately 8 percent (27 of 355 samples) contained these organisms. *Salmonella* isolations were made from complete feeds and from protein supplements included in these feeds. Feeds intended for use in chickens, hogs, and dogs were found to be contaminated. Nineteen serotypes were identified among the isolates recovered.—John T. Bryans and Bruce Poundstone.

**Cultivation of vibrio fetus from contaminated material.**—A selective medium composed of albimi broth, 2 percent agar, 10 percent sheep blood, 10 units/ml of Bacitracin and 10 u/ml of Polymyxin B was found to be highly effective for isolation of *V. fetus* from feces.—John T. Bryans.

**Biochemical characteristics of *Vibrio fetus*.**—*V. fetus* cultures isolated from aborted bovine and ovine fetuses and from hepatitis in chickens were compared. The important biochemical characteristics of pathogenic cultures were found to be the ability of a culture to decompose hydrogen peroxide, and its inability to grow in 4 percent NaCl. Hydrogen sulfide production or inability of a given culture to produce this gas has little if any correlation with pathogenicity. The ability of cultures isolated from bovine fetuses to tolerate 1 percent oxgall is a useful distinguishing characteristic of these isolates. Catalase negative *Vibrio spp.* isolated from the bovine genital tract are bile soluble.—John T. Bryans and Alice G. Smith.

**Vibriosis in sheep.**—*V. fetus* infection in sheep caused by the type of *V. fetus* isolated in Kentucky has been shown to be a low-grade intestinal infection. The infection is easily transmissible to lambs in contact with fecal shedders. Bacteremia is an almost constant feature of the infection. *V. fetus* can be cultured from the blood for 1 to 4 days and from the feces for as long as 18 days after oral inoculation of cultures. The infection is demonstrable only by bacteriological culture. There are no obvious clinical manifestations. The bacteremia is not attended by significant deviation in total leukocyte counts. *Vibrio fetus* can be cultured from the gall bladder bile and mesenteric lymph nodes of a high percentage of lambs killed as long as 24 days after inoculation. These results provide for a more complete understanding of the pathogenesis and epizootiology of *V. fetus* infection in sheep.—John T. Bryans and Barbara P. Shephard.

**Equine Salmonellosis.**—Field studies during the past year have emphasized that *Salmonella* infection is an important problem in horses. A killed bacterin containing *S. typhimurium* and *S. enteritidis* has been tested for its ability to limit outbreaks. The results of these field tests indicate that the bacterin is a useful prophylactic. Three farms using bacterin had no recurrence of Salmonellosis in the year following the primary outbreak. Two farms not using bacterin experienced recurrence of the infection in 1960. The carrier state has been shown to persist in horses for as long as 14 months.—John T. Bryans.

**Viral diseases of horses.**—Field testing of a vaccine for rhinopneumonitis included vaccination of 1,378 pregnant mares on 38 farms. Viral abortions occurred subsequently in 18 (1.3%) of the vaccinated mares. There were 22 abortions by non-vaccinated mares on 11 farms. The cumulative total of vaccinations for 2 years includes 2,218 pregnancies, of which 10 terminated in abortion from infection by the vaccine virus and 18 in abortion from infection by native virus, for a percentage of 1.25. In the same period there were 47 abortions on 24 farms involving 337 mares for an abortion rate of 14%. Rhinopneumonitis virus has been propagated in monolayer cultures of equine and porcine kidney, in which it produces cytopathogenic alterations with intranuclear inclusion bodies. Equine arteritis virus was propagated in cultures of equine kidney with accompanying cytopathogenic changes. Periodic inoculation of horses with arteritis virus propagated in kidney cultures indicates that pathogenicity is being reduced with succeeding passages.—E. R. Doll.

## DAIRY SCIENCE

**Whole milk or milk replacers fed ad libitum for veal production.**—Twenty 2-day old male Holstein calves obtained from institutional herds locally were divided into four groups and placed on the following rations for 8 weeks. Group 1 received whole milk with chlortetracycline (aureomycin) and groups 2, 3, and 4 each received a different commercial milk replacer diluted with 9 parts water. All calves were offered all the milk or milk replacer desired three times a day. Of fecal samples taken from 15 calves during the eight weeks, 11 calves excreted *Salmonella typhimurium*, a scour-causing organism. The broad-spectrum tetracycline antibiotics were ineffective in preventing widespread scours. However, another antibiotic, neomycin sulfate, was quite effective in reducing the scours caused by the above organism and in the comparison made allowed the calves to gain 0.2 lb/day more, even though milk consumption was similar. The stress of heavy feeding appeared to contribute to the scours and probably lowered the calves' resistance to the organism. Ad libitum feeding was not advisable, at least for the first 10 days. For groups 1 through 4, in order, the results were: Number of calves that died, 1, 0, 1, and 1; average beginning weight, 92, 90, 94, and 96 lb; average daily gain, 2.3, 1.4, 0.6, and 1.5 lb; average daily consumption, 22, 22, 20, and 23 lb; average yield, 60, 56, . . . (no data), and 57%; average whole carcass value at \$0.48 lb, \$65.16, \$38.81, and \$42.77; average value of whole milk or replacer where original value of calf, labor and other costs are fixed at \$25.00, \$3.72, \$1.14, and \$1.36 per 100 lb. A 25-lb bag of milk replacer would be worth 2.5 times the previous value or \$2.85 and \$3.40. Average difference between carcass value and feed cost where milk is priced at \$3.50/cwt and milk replacer at \$4.50 per 25-lb bag, \$22.64, \$17.03, . . . (no data), and \$19.19.—Don R. Jacobson and W. M. Miller.

**Bloat studies.**—An attempt has been made to determine the total and stable froth formation, surface tension and relative viscosity of



rumen samples taken from animals grazing different pastures. Also, the mode of action of several compounds in preventing bloat has been studied. Stable froth formation (increase in volume in one hour over original weight of rumen samples in vitro) before feeding, one half hour after feeding, and 1.5 hours after feeding respectively, was; for sudan grass, 20%, . . . (no data), and 25%; for non-bloat-producing Ladino, 2%, 23%, and 13%; for non-bloat-producing alfalfa, 10%, 32%, and 31%; for the same forage but animals received penicillin, 7%, 20%, and 20%; for bloat-producing alfalfa, 14%, 53%, and 42%; for the same forage but animals received penicillin, 8%, 18%, and 13%. The additional froth formed from additives in vitro in the same order with respect to time of sampling was: for glucose, 3%, 17%, and 15%; for starch, 13%, 14%, and 11%; for Ladino juice, 23%, 8%, and 20%; for glucose + extract, 34%, 41%, and 26%. The same data for relative viscosity and surface tension indicate that relative viscosity changes little and is not associated with the incidence of bloat, whereas surface tension increased somewhat from before feeding to 1/2 hour after feeding when most of the bloat developed. Several surface active compounds and turpentine were effective in reducing froth formation both in vitro and in vivo. When penicillin was administered daily its presence was detected in the rumen at 24 hours after administration for 6 to 12 days. Three fields have been seeded to either Ladino or alfalfa and irrigation facilities have been developed. Heavy irrigation and pure stands are required to obtain a fairly high incidence of bloat for intensive study. —Don R. Jacobson, W. M. Miller, and R. H. Hatton.

**A study of production records of artificially sired Holstein cattle.**—A total of 4,315 DHIA records made during the period 1952-1958 by daughters of Kentucky Artificial Breeding Association Holstein sires were summarized. Registered Holsteins averaged 427 lb fat, as compared to 421 lb for grade Holsteins. The yearly averages increased from 411 lb in 1952 to 431 lb in 1958. Sires were ranked by daughters average and also by contemporary comparison. Approximately 90 first-services to a sire were necessary to result in one reported DHIA record 3-4 years hence.—Robert E. Walton and Donald W. Heilman.

**Relationship of bacterial types to spoilage of pasteurized milk held at certain refrigeration temperatures.**—The identification of the original 100 psychrophilic cultures has proved to be a laborious task due to the tenacious attraction among some of these organisms. This suggests a synergistic relationship among certain psychrophilic organisms. Some original isolates have yielded 6 to 10 distinguishably different varieties.—W. E. Glenn.

**Comparison of two newly bred strains of fescue and Kentucky synthetic orchard grass.**—This was the second year for this comparison. The methods were similar to last year except that the heifers were not given chromic oxide nor were fecal samples obtained. During the season (Apr. 16 to Sept. 30) the average results, respectively, for the 45-50 outcross, the three-family mixture of fescue, and Kentucky syn-

thetic orchard grass, were as follows: calculated TDN production per acre, 2,431, 2,633, and 2,478 lb; average daily gain, 1.34, 1.54, and 1.55; respiration rate per minute during August and September, 90, 75, and 45; body temperature during August and September, 103.5, 103.3, and 102.3°F. Some other grasses, mostly bluegrasses and orchard grass, volunteered into these plots both years. An animal (No. 359) on a 45-50 fescue outcross plot appeared to be the most abnormal. Though there was no clear evidence of gangrene, she had a rough hair coat, a dull glassy-eyed appearance, a temperature of 104.3°F, and a respiration rate of 118 per minute during August and September, and an average daily gain of 1.25 lb over the entire season.—Don R. Jacobson, Robert Buckner, W. M. Miller, Robert Hatton, Paul Burrus, Arthur Graden, and D. M. Seath.

**Comparison of Kentucky bluegrass and 45-50 fescue for dairy heifers.**—This, the third year of this comparison, was an excellent year for pasture performance because of even rainfall. It did not include chromic oxide administration or twice daily fecal sampling for intake and digestibility determination. Consequently, animal performance might be expected to be improved. During the season (April 16 to Sept. 30) the average results for bluegrass and 45-50 fescue, respectively, were as follows: calculated TDN production per acre, 1,932 and 1,751 lb; average daily gain, 1.50 and 1.44 lb; respiration rate during August and September, 43 and 57; body temperature during August and September, 102.2 and 102.6°F. Some bluegrass volunteered into one of the fescue plots but didn't seem to influence animal gain.—Don R. Jacobson, Robert Buckner, W. M. Miller, Robert Hatton, Paul Burrus, Arthur Graden, and D. M. Seath.

**Good quality Tracy sorghum silage vs. good quality alfalfa hay for milk production.**—Twenty-four Jersey and Holstein cows were divided into four similar groups and offered the following forage: Group 1, silage only ad libitum; Group 2, silage ad libitum and 6 lb hay/day; Group 3, 20.8 lb silage/day and hay ad libitum; Group 4, hay only ad libitum. Groups 1 and 2 were fed a 20% and groups 3 and 4 a 12% crude protein concentrate individually according to milk production, butterfat test and body weight using Feeds and Feeding Table no. 8 for usual rate of feeding good hay. Over the 8 weeks experiment, the average results for groups 1 through 4 were as follows: Preliminary milk production, 36, 36, 36, and 36 lb/day; last week's milk production, 33, 34, 35, and 33 lb/day; persistency of milk production, 95, 96, 99, and 97%; forage dry-matter consumption per 1,000 lb BW adjusted to BW<sup>0.75</sup>, 18.5 22.9, 23.2 and 18.7 lb/day. Since milk production was maintained at an above-normal level, indications are that either good quality silage (this was cut at milk stage of maturity) or good quality hay or combinations of the two may well be employed in a sound feeding program.—Don R. Jacobson, D. M. Seath, Arthur Graden, and R. H. Hatton.

**Effect of amount of grain and quality of roughage fed on growth and milk production of dairy cattle.**—In 1960 sixteen Holstein and

eleven Guernsey heifers were added to the project, bringing the total to 33 and 40 animals of each breed, respectively. Weight and measurement data are accumulating rapidly. Among the 30 Guernseys at one year of age, the grain fed group have averaged 75 lb heavier, 1.1 inches taller, and 2.3 inches greater in heart girth than the no-grain group. Corresponding figures for 14 year-old Holsteins are 88 lb, 2.6 inches, and 2.9 inches. Sixteen Guernseys will shortly have completed at least one lactation. The Holsteins are just now coming into production.—Robert E. Walton and D. M. Seath.

**Preparation and use of frozen cultures for making cultured milk products.**—Using 13% reconstituted nonfat dry milk and University of Kentucky culture A, a number of lots of starter for cottage cheese and cultured buttermilk were produced on a small plant scale. This starter was bottled in paper milk cartons, frozen at  $-18^{\circ}\text{F.}$ , stored from 3 to 150 days, and used as a direct inoculum for cottage cheese and buttermilk. No failures traceable to the starter were noted, but activity of the starter decreased as aging increased. Work is continuing on a laboratory scale to determine resistance of other cultures to frozen storage, best concentration of milk solids for protection of organisms during frozen storage, and use of  $\text{CaCO}_3$  as a means of maintaining activity.—A. W. Rudnick, Jr. and W. E. Glenn.

**Gas defects in cheddar cheese.**—The data obtained to date indicate little relationship between the occurrence of gas defects in the finished cheese and results from the following tests: quality of raw milk, Coliform Plate Count and/or Standard Plate Count organisms in pasteurized milk, coliform organisms in the whey at milling time, the presence of phage in the whey as detected by the TTC test, and/or gas-producing qualities (as measured by the 6-hr test) of the starter. There also appears to be no important relationship between the sanitation-housekeeping inspection rating of the cheese plant and the occurrence of the gas defect in fresh or ripened cheese.—W. E. Glenn and T. R. Freeman.

**Problems in processing and marketing creamery butter in Kentucky.**—Of the 95 churnings of creamery butter examined by the phosphatase test during the year, some 23% were found to be "positive" 24 hours after churning. It was suspected that the method of processing employed in certain creameries might result in the production of butter with "negative" phosphatase values (indicating proper pasteurization) immediately after churning, which became "positive" when tested 24 hours later. This theory was tested on 32 churnings of butter all of which had "negative" phosphatase values immediately after churning. Of these, 7 (22%) had "positive" phosphatase values at the 24-hour period.—T. R. Freeman and John L. Bucy.

**Levels of deoxyribonucleic acid (DNA) in bovine spermatozoa and their relationship to fertility and delayed returns.**—Data from 34 ejaculates of 10 bulls indicated a correlation coefficient of 0.43 ( $P < 0.05$ ) between DNA level and fertility among ejaculates within



bulls. However, on an among-bull basis, the correlation coefficient was  $-0.35$  (not significant). The proportion of delayed returns to service was increased for ejaculates having either high or low levels of DNA.—Durward Olds and William R. Summerhill, Jr.

**Fertilization rates in repeat-breeding dairy cows.**—A total of 64 animals have been bred early and/or late in the heat period and slaughtered three days later. Ova were recovered from 38 of the cows, of which 60.5% were fertilized. Numbers are still too small to evaluate the effect of time of breeding. It was observed that 10.9% of the animals failed to ovulate and a similar number had obstructions of the oviduct. Failure to find ova in 26.9% of the eligible cows appears to be a major problem. A few apparent abnormalities of ova have been observed as well as histopathological conditions of the uterus.—Durward Olds and Arthur P. Graden.

## ENTOMOLOGY AND BOTANY

**European corn borer and corn earworm studies.**—Granular toxaphene, endrin, and phosdrin were applied to 15 sweet corn hybrids in two European corn borer control tests. In a test at the Woodford County Farm borer counts ranged from 60 per 100 stalks in Golden Sensation and Staygold to 220 in Deligold. Endrin, 1 percent, 15 pounds per acre reduced this population to zero in the first hybrids mentioned and to 20 borers per 100 stalks in Deligold. Deligold matures in 71 days and the other two in 79 days. Toxaphene, 10 percent, 20 pounds per acre was next best. It was more effective than phosdrin, 1.5 percent, at either 15 or 25 pounds per acre. Early maturing hybrids were less resistant to borer and control was more difficult.

The same hybrids were tested for corn earworm resistance. In the Woodford test, W. S. Longchief, Golden Sensation, and Staygold gave 54, 46, and 39 percent worm-free ears respectively compared to 15 and 2 percent for Evertender C and North Star. North Star matures about 10 days earlier than those mentioned.

Three varieties of sweet corn were tested for insecticidal-variety interactions. Results on the basis of no spray, daily spray (during silking), and alternate-day sprayings with DDT showed no interactional differences; daily sprays reduced infestation by 37 percent and alternate-day sprays by 30 percent.—J. G. Rodriguez and Dean Knavel.

**Strawberry insect studies.**—Work was continued in the study of insecticide performance and insecticide residues when treated by low pressure-low gallonage and by high pressure-high gallonage spray applications. These were DDT, Thiodan, kelthane, and captan wettable powders applied at 30 pounds pressure and 100 gallons per acre, versus 200 pounds pressure and 250 gallons per acre. Thiodan was applied at pre-bloom only; the other materials were applied at early bloom, full bloom, and one day before harvest. The test blocks were free of mites or insects and insecticide performance data were not taken. Yield records showed that plots treated with Thiodan were significantly

lower in production. Yield records also showed 362 and 360 crates per acre for the low and high series respectively, compared to 453 crates for the untreated check. None of the other treatments were significantly different. Residue analyses by the Pesticide Chemicals Research Branch (USDA) showed that the residues were considerably below those found in the previous 3 seasons. In no instance did the residues found exceed established tolerances.—J. G. Rodriguez and C. E. Chaplin.

**Studies in an insecticide control program on dent corn.**—Work was designed to evaluate soil treatment during planting and various insecticide foliar applications during the growing season. Blocks treated with aldrin and heptachlor and an untreated block were subplotted to receive (1) toxaphene spray at the 5-7 leaf stage for flea beetle control, (2) endrin granules for first generation corn borer control, (3) both of the above mentioned treatments, (4) endrin spray at the 50 percent silking stage to control corn earworm, and (5) an untreated check. The test area did not develop a significant infestation of any insect. Harvest yield data showed this lack of injury. There were no significant differences between treatments.—J. G. Rodriguez.

**Studies on vegetable insect control.**—Broccoli, cabbage, potatoes, peppers, egg plant, lima beans, squash, and tomatoes were grown in replicated plots and these were treated with endrin, perthane plus malathion, toxaphene, dibrom, thiodan, and ethion in a test of general performance against vegetable insect pests. The treatment of perthane plus malathion, 1 pound of each per acre, was superior against the various cabbage worms attacking broccoli and cabbage, followed closely by endrin at 0.5 pound per acre. Control of light populations of fleabeetles attacking potatoes, peppers, and egg plant was better with thiodan, 1 pound per acre. Butternut squash was apparently stunted with endrin, 0.5 pound per acre, but at 0.25 pound per acre it gave superior over-all control of insects attacking squash. Toxaphene was not applied to squash because it is phytotoxic to cucurbits.

Harvest yields of California wonder peppers showed unexplainable decreases in yield in all treatments compared to the untreated check. In egg plant endrin increased yields by 3 to 5 times over the check. Endrin, perthane plus malathion, and dibrom gave significant yield increases in broccoli but not in cabbage. (However, had the cabbage been graded, little of the untreated cabbage would have been salable.) Endrin increased yields significantly in tomatoes. In potatoes all materials increased yields significantly over the untreated check; endrin increased yields 30 to 90 percent.—J. G. Rodriguez.

**Studies with various mites.**—Work continued on soybean resistance to two-spotted spider mite attack. One hundred different lines were artificially infested in the field and evaluated for resistance. One established variety, Dorman, and seven "plant introductions" were found resistant compared to nine other susceptible lines.

Ecological studies were conducted on sheep and cattle pastures to determine if qualitative and quantitative differences exist between

mite populations in the two localities and to study possible diurnal fluctuations in the numbers of species occurring in the situations studied. Examined material indicates that the sheep pasture contained more mite fauna than the cow pasture.

Work continues in evaluation of macrochelid mites as predator agents of the housefly egg.—J. G. Rodriguez.

**Systemic materials in mimosa webworm control.**—The following methods were employed in an experiment designed to study control of the mimosa webworm on moraine locust trees about 3 to 4 inches in diameter: (1) granules, broadcast and worked lightly into the soil and watered in, (2) granules poured into holes ("plugs") 1½ inches by 12 inches and watered in, (3) water solutions, sprinkled on by watering can and watered in, and (4) sprays and granule combinations. Applications of treatments were made May 19 except the spray-granule combination treatments which were made on June 29. Di-Syston, 5 percent granules, broadcast in a 10 foot diameter at 4 and 8 ounces of the actual material per tree and watered in gave 100 percent control for the entire season. Phorate at the same dosage was only slightly less effective. The combination granule and spray method was next in effectiveness, followed very closely by the sprinkling can method. Not effective was the granule-in-holes method. The test was conducted in central Kentucky with a cooperating nursery, using one-tree replicates and five replicates per treatment.—J. G. Rodriguez.

**Insect pests of grain sorghum.**—Statistically significant differences in the susceptibility of 22 sorghum selections to corn earworms and European corn borers was found at Lexington. Sorghum webworm populations were too variable for reliable comparisons. The infestations of earworms ranged from 12 per 100 heads in Combine Shallu to 202 per 100 heads in Combine 7078. In general, selections with compact heads had more earworms than those with loose heads but the data indicated other factors were involved. Late plantings had more earworms than early plantings. The reverse was evident, however, with borers. Corn borer infestations varied from 9 per 100 stalks in Manchu Brown Kaoliang to 81 per 100 stalks in White Durra. Selections with few earworms did not necessarily have borers although some indicated resistance to both pests. Unbored plants did not yield higher than bored plants, probably because most of the borer entrance was after seed had started to form. However, the number of bored heads or stalks that were broken by harvest time ranged from 20 percent in Durra to 90 percent in Combine 7078. Breakage was probably enhanced by a stalk disease which was present in over 98 percent of the bored plants. Also, there was a significant difference among selections in the location of borer entrance. There was no significant correlation of insect infestation to head color or plant heights. Borer results at Princeton complemented those of Lexington.

Plants from the selfed seeds of sorghum selected for resistance to corn aphids in 1959 were again screened in the field in 1960. Six seed heads were selected for resistance.



Endrin, sevin, and toxaphene gave fair control of earworms and borers. Toxaphene spray caused leaf discoloration but yield was not reduced. Thimet and di-syston, both systemic insecticides, and an anti-feeding compound did not give satisfactory results but the timing of applications was late. Malathion gave poor control of corn leaf aphids although up to 3 applications were made, and the dosage of 3 P/A was sufficient to cause plant injury. Leaf burning was more prevalent with low water gallonage, whereas growing point damage was more common with high water gallonage. Phytotoxicity was caused by the solvent instead of by the insecticide in the emulsifiable concentrate.

So far, effective bird repellents for use on grain sorghum in the field have not been found.—Kenneth J. Starks and James F. Shane.

**Insect transmission of viruses.**—Tests at Eden Shale indicated that insecticidal treatments have been erratic for the prevention of streak virus of burley tobacco, supposedly transmitted from sweet clover by an arthropod. Caging tobacco reduced but did not eliminate the appearance of streak. One plant had streak in a laboratory transmission study using tobacco flea beetles. However, the results could not be repeated.

Aphids from solanaceous and other weeds associated with tobacco fields were collected at about 3-week intervals starting June 15. Identifications are not complete. Three species reproduced on burley. One species, probably *Macrosiphum solanifolii*, transmitted an etch-like disease from ground cherry to Ky. 51.—Kenneth J. Starks.

**Insecticidal residues.**—Chemical analysis of alfalfa, bluegrass, and sorghum foliage as well as sorghum seed heads indicated that about 80 percent of sevin residue dissipated within two weeks. Increasing the rate from 1 to 2 pounds per acre did not double the initial amount of residue. Also, the residue at the end of two weeks was near the same for the two rates.—Kenneth J. Starks.

**Insects attacking grasses.**—The cause of silver-topping of Kentucky bluegrass was studied in the field and in the greenhouse. The theory that the blasted seed head was caused by a virus was not supported, as symptoms were not produced by mechanical inoculation, dodder bridges, and phytophagous mites transferred from blasted stems to healthy stems. Mechanical injury produced silver-top when stems were crushed before the seed head emerged from the leaf sheath. Unlike typical silver-top in the field, however, mechanically injured stems had small panicles and chlorotic leaves above the injured site. The feeding of plant bugs produced blasted seed heads but this injury differed from typical silver-top as the spikelets were unevenly damaged and the rachis was green instead of white. Thrips were not related to silver-top and individuals were not reared in the laboratory. Fly larvae of the family Chloropidae were found in about 10 percent of silver-topped stems, whereas none was found in apparently normal stems. Two species of frit flies were reared from bluegrass stems and 9 spe-

cies were collected from fields by sweep net. Fertile eggs have not been obtained under caged conditions.

Adult flies were controlled by insecticide sprays applied May 15 but there was no significant differences in the incidence of silver-top as the symptoms had already started to appear at the time of treatment. However, a low occurrence of silver-top has been observed after fields have been treated with an insecticide for several years.

Dieldrin and toxaphene gave good control of the plant bug, *Amblytylus nasutus*, whereas thiodan gave fair results. Dieldrin was the only material which effectively controlled *Leptopterna dolabratus*.

Several bluegrass lawns treated with hydrocarbon insecticides have developed damaging populations of sod webworms. Preliminary tests have indicated that such treated lawns in comparison with untreated grass may have fewer predaceous beetles.

Feeding tests of white grubs on species of grasses were not conclusive. Chlorinated hydrocarbon sprays increased leafhopper populations on bluegrass. Mowing decreased leafhoppers.—Kenneth J. Starks.

**Legume insect pests.**—Alfalfa plots were too small for evaluating chemical control of insect pests except for nymphal leafhoppers. Sevin was the most effective of five materials against the potato leafhopper.

Fall armyworms caged in the field burrowed into the ground and pupated but did not survive the winter.

Clover root borers and clover curculio larvae did not damage spring planted red clover to any extent the first year. By August of the second year over 60 percent of the plants had tunnelled roots.

The optimum time to spray for spittlebugs is the start of the second instar, which is influenced by temperature. Head capsule measurements indicated the second instar was reached at Lexington on April 16. By using daily temperature averages above a 50°F base, the accumulated degrees were 148 by April 16.—Kenneth J. Starks.

**Biology of tobacco insects.**—Budworms collected in late June and early July in tobacco fields and reared in the greenhouse were approximately 90 percent *Heliothis zea* and 10 percent *Heliothis virescens*. Less than one percent of the budworms collected in September were *H. virescens*. The pupal stage averaged 14-15 days. Thirty-two percent of the budworms collected in June and July were parasitised. Of the 25 cases of parasitism one was caused by *Campoletis argentifrons* and the rest by another wasp parasite, *Cardiochiles nigriceps*. However, cases of fly parasitism were found fairly abundantly in September and October.

Daily catches of hornworm moths in a light trap averaged 3.7 in June, 10.7 in July, 31.8 in August, and 7.0 in September. Seventy-nine percent were males and 21 percent were females. Sixty-seven percent were identified as *Protoparce sexta* and 33 percent as *P. quinquemaculata*. October 17 was the last date a hornworm moth was taken in the trap. Moth catches were much higher in June and July of 1960 than in 1959, but about the same in August of these years. The heaviest moth flights occurred during the last two weeks of August, somewhat

earlier than the peak moth flights in 1959. The abundance of hornworm larvae in the field was correlated with the relative numbers of moths caught shortly before. Numbers of *Protoparce quinquemaculata* larvae compared to *P. sexta* larvae were lower than the relative number of moths of these species caught in the light trap. Eighteen percent of the larvae were *P. quinquemaculata* in August and in September only 5 percent were this species.

In August, 24 percent of the hornworms were parasitised by *Apanteles congregatus*, in September 21 percent, but in October 64 percent were parasitised. Plots of tobacco treated with endrin at 1.6 ounces per acre and TDE at 16 ounces per acre on August 8 had 4 and 5 percent parasitised hornworms respectively on September 12, while the untreated plots had 22 percent parasitised hornworms.—Richard Thurston.

**Insecticide tests on insects attacking tobacco.**—Both thimet and aldrin at 3 pounds per acre applied to the soil before transplanting gave excellent control of wireworms. The following materials in ounces per acre were used in two tests for control of fleabeetles: dylox, 16; thiocan, 8; guthion, 8; sevin, 16; endrin, 3.2; TDE, 16; and diazinon, 4. Of these insecticides guthion and sevin gave the best control. All the materials in these tests, when used in a spray schedule, gave good control of the green peach aphid except sevin and TDE. In a single application test against the green peach aphid the following materials in ounces per acre were used: dylox, 8; thiocan, 8; thiocan, 6; SD4402, 4; SD3562, 8; guthion, 8; sevin, 8; malathion, 10; dimethoate, 8; diazinon, 4; and endrin, 3.2. Two days after treatment malathion, SD3562, and dimethoate were the best materials for control of aphids, but both thiocan treatments appeared very promising a week after treatment.

Sevin and SD4402 at 16 and 6 ounces respectively appeared promising for the control of the false tobacco budworm. In a large field-scale test on a small population of budworms, thiocan at 8 ounces per acre was as effective as endrin at 4.8 ounces, but neither was outstanding. The following materials were used in indicated ounces per acre: *Bacillus thuringiensis*, 64; sevin, 16; SD4402, 4; dimethoate, 8; guthion, 8; thiocan, 8; dylox, 16; and GC4072, 16. *B. thuringiensis*, sevin, guthion, and dylox gave better than 90 percent control of hornworms; SD4402 and GC4072 appeared promising, giving 81 and 85 percent control, respectively.

Residues of endrin and TDE did not seem to be greatly, if at all, decomposed during the normal burley tobacco curing process, except when high (0.8 lb per acre) rates of endrin were used. TDE left considerably higher residues per unit applied than did endrin. Thiocan, phosphamidon, dimethoate, Hercules 5727, kepone, and sevin gave no off-taste or flavor to burley tobacco in smoking tests.—Richard Thurston.

**Phytotoxicity of insecticidal formulations to tobacco.**—One brand of 10 percent DDT dust was found to be highly toxic to tobacco in



plant beds. At the recommended rate this dust caused only a small amount of leaf chlorosis and subsequent leaf injury except where uneven applications caused locally heavy deposits of dust. At twice the recommended rate severe injury resulted, and at four times the recommended rate most of the small plants were killed. The diluents used in formulating this dust were not phytotoxic. Other brands of 10 percent DDT dust applied at four times the recommended rate were only slightly more toxic than this brand at the recommended rate.

Two types of emulsifiable concentrates, a methylated naphthalene type and a xylene type, at various dosages and dilutions in water were sprayed at different heights from tobacco plants. Using the recommended dosage of either type of spray was the most important factor in preventing spray injury. When heavy dosages per acre of the emulsifiable concentrates were used, increasing the water in the spray from 10 to 100 gallons per acre prevented leaf burning whether the spray nozzle was held close (4") or far (15") from the plant. However, this did not prevent burning of the tobacco buds. The correct spraying distance (15") prevented bud burning but not leaf burning when 10 gallons of water per acre were used. The most severe injury was caused by the heavy dosage of methylated naphthalene in 10 gallons of water per acre with the spray nozzle held 4" from the plant.—Richard Thurston.

**Resistance to tobacco insects.**—In two field tests all resistant selections of tobacco introductions were more resistant to the green peach aphid than were burley varieties. Crosses with Kentucky 58 and back crosses with Kentucky 58 were intermediate in resistance. Kentucky 61 was again the most susceptible of the burley varieties tested, both in percentage of plants infested and in number of aphids per plant. Plants from a selection of Kentucky 58 were less heavily infested than standard Kentucky 58 plants or other burley tobacco plants. Irradiation of Kentucky 58 and Kentucky 61 seeds did not affect aphid susceptibility. Resistance in wild *Nicotiana* species was similar, whether infestations were produced by free-flying alate females or by manual infestation with apterous females.

There was no preference in oviposition by caged *Heliothis zea* moths on *Nicotiana* species. Free-feeding cage tests with *H. zea* larvae and by *Protoparce sexta* larvae showed that most *Nicotiana* species were eaten by both insects but that a few species were relatively undesirable. Similar results were obtained in field tests.—Richard Thurston.

## HOME ECONOMICS

**Why consumers select specified foods.**—In a study of factors affecting decision-making by over 6,000 consumer-families in 110 urban areas of six southern states, data compiled by Kentucky indicated that 51 percent of the white homemakers and 41 percent of the Negro homemakers had been influenced by newspaper food advertisements to buy a specific food item during the month previous to the interview. This influence increased as per capita income and level of education

rose, and as age of the homemaker increased up to age 60 for white and age 50 for Negro homemakers. Food advertising on television and special store displays rated second and third place in guiding homemaker food purchases. Almost half the homemakers were influenced by family members to buy a certain product. This influence was highest in families with relatively low per capita incomes of \$900-1,199, but increased as education of the homemaker increased.—Mildred R. Wightman and John B. Roberts.

**Consumption of poultry meats in Kentucky.**—Kentuckians consume 10 percent more poultry meats per person than the national average, according to data based on interviews with 527 representative Kentucky families. Almost all of this excess was consumed as fried chicken. Total yearly consumption per family member was estimated at 23 pounds of fried chicken, 6 pounds of stewed or roasted chicken, and 5.5 pounds of turkey. When asked about preferred type of package, two-thirds of the homemakers favored "tray-pack friers." The larger, more meaty parts, legs, thighs, and breasts were liked better than such parts as necks, gizzards, liver and wings, but most respondents felt the most economical way to buy was to purchase whole birds. Only in the higher income groups did the homemakers purchase only the pieces they liked most. For the ordinary homemaker the problem was one of finding ways to get all the chicken eaten once it was bought. Generally, families in the higher income groupings were more willing to try new ways of preparing and serving poultry.—John B. Roberts and Mildred R. Wightman.

**Food technology.**—(In cooperation with Horticulture Department; see page 65.)

## HORTICULTURE

**Vegetable breeding.**—Screening and selection of tomato lines in the  $F_2$  and  $F_3$  populations were confined to resistance to Fusarium wilt, verticillium wilt, and gray leafmold. Selections were made for desirable horticultural characteristics of the resistant plants. In a variety-breeding line test in the greenhouse at Eden Shale an  $F_2$  and two  $F_4$  breeding lines outyielded Michigan-Ohio hybrid as much as one pound of fruit per plant. The fruit rated with the hybrid in other characteristics.

Selections were made in the  $F_2$  and  $F_3$  populations of snap bean lines for stringless pods, concentrated pod setting, and bush White Half-runner types.—Dean E. Knavel.

**Vegetable variety testing.**—Variety trials were conducted on a number of vegetable crops at Eden Shale and Lexington. Sixty-five sweet corn varieties were entered in two separate trials at both locations. Golden Security and Surecrop were the leading varieties at Eden Shale with 1,576 and 1,698 dozen marketable ears per acre. Stay-gold was outstanding at Lexington with 1,908 dozen ears per acre. A very early corn (74 days), Northern Belle, was resistant to frost and

bacterial wilt and yielded 2,368 dozen ears per acre as compared to 1,132 and 1,268 dozen per acre for North Star and Carmelcross, respectively. Several varieties of the 50 in an observational plot looked promising for further testing.

Snap bean yields were high at both locations this year. Twenty-three varieties were under extensive trial and twenty-four under observation. A yellow variety, Resistant Cherokee, yielded 415 bushels per acre at Eden Shale. The best green podded varieties at Eden Shale were Wade, Topcrop, Harvester, and Extender, with yields in the 270-290 bushels per acre range. A breeding line, B-3370, yielded 397 bushels per acre at Lexington, while Extender yielded 331 bushels per acre in the same trial. Of the 24 varieties under observation, many yielded as much as 400 bushels per acre. Kentucky Wonder was the outstanding pole bean variety of ten tried, with 730 bushels per acre.

A new breeding line of tomato, S.T.E.P. 341, yielded highest at both locations, with 21,417 pounds per acre at Eden Shale and 29,791 pounds per acre at Lexington. Rutgers' average yield for both locations was 14,809 pounds per acre. The best appearing tomato varieties of the ten in trial were S.T.E.P. 341, Marion, and S.T.E.P. 346. Fifty additional varieties were under observation; the majority rated poorly as compared to Rutgers.

Nine varieties of pickle cucumbers were under trial at Lexington. An experimental  $F_1$  hybrid yielded 1,000 bushels per acre. MR-17 yielded 870 bushels per acre with more vine growth than any other variety in trial.

Irish Cobbler, Onaway, and Kennebec were the leading white-skinned potatoes of 29 varieties of potatoes under trial. Redburt and Red Warba were the highest yielding red-skinned potatoes. These varieties had fair specific gravities and a high percentage of the tubers classified as US #1 grade or better.

The best cantaloupe varieties were Harvest Queen and Delicious-51, of eleven tested. Three varieties of pumpkin showed Sugar Baby outstanding. Tri X-313 (seedless) was the best flavored watermelon out of six in the test. Table Queen and Butternut were the favored winter squash out of four varieties tried.—D. E. Knavel.

**Weed control in vegetable crops.**—One hundred-twenty herbicide treatments were applied to seven vegetable crops. Chemicals that either warrant further testing or are being recommended for use in vegetables are as follows: (Herbicides underlined are those recommended for 1961.)

Sweet Corn — DNBP, CDAA-T, Simazine, Amiben, Atrazine, Eptam, Stauffer 2061.

Potatoes — DNBP, Lilly 31864, Dacthal, Zytron, Diuron.

Cole Crops — Dicryl, Niagara 5996, CDAA-T, CDEC, Dacthal.

Snap Beans — DNBP, CDAA-T, Lilly 31864, Zytron, Eptam, Dacthal, Amiben, Stauffer 2061, 1607.



- Tomatoes — Lilly 31864, CDEC, Dacthal, Simazine, Amiben, Solan.  
Peppers — Simazine, Dacthal, Eptam, CDAA-T.  
Cucumbers — Alanap, Niagara 5996, Dacthal, Dicryl.

In one experiment granular and spray formulations of 11 herbicides were compared. Weed control from granular treatments of Simazine, DNBP, CDAA-T, and Zytron was significantly better than from the spray applications. Herbicide treatments that resulted in no significant difference between formulations were 2,4-D, Falone, Diuron, Eptam, experimental herbicides 2060, 2061, and 1607.—J. W. Herron and Donald J. Cotter.

**Influence of plant nutrition and tobacco mosaic virus on incidence of blotchy ripening and internal browning of tomato fruit.**—Experiments using standard nutrient culture techniques with deficient, intermediate, and excessive levels of nitrogen, potassium, and boron factorially arranged with tobacco mosaic virus (TMV) inoculations were conducted.

Blotchy ripening was greatest on potassium-deficient treatments, while nitrogen boron and TMV did not significantly influence percent blotchy ripening. High levels of nitrogen resulted in more severe symptoms than deficient levels. Deficiency potassium levels resulted in greater severity of blotchiness than intermediate or excessive levels.

The main effects of nitrogen, potassium, boron, and tobacco mosaic virus were not significant when considering percent of fruit affected with internal browning. Severity of internal browning was increased by high levels of nitrogen. Potassium, boron or TMV had no effect on the severity of internal browning.

Mineral and organic determinations are being conducted to study the problem more adequately.—Donald J. Cotter.

**Potassium nitrate as a fertilizer for tomatoes.**—Potassium nitrate contains both elements (nitrogen and potassium) which are essential to good tomato yields. It is becoming more available at reasonable cost. It would seem that absorbing potassium and nitrogen together might give better results than taking each up in different compounds. Tests were made comparing potassium nitrate to the use of equivalent amounts of ammonium nitrate and potassium sulfate. In all four tests, each containing four replications, potassium nitrate gave significant increases in both early and total yields. However, in some cases the yields were better where a complete fertilizer was used at the start, followed by potassium nitrate applications. The results of these tests give indications that feeding tomatoes with one salt is better than using two different compounds.—E. M. Emmert.

**Spraying tomatoes with hormone, boron, and fertilizer solution.**—In 1959, a complete soluble fertilizer mixed with hormone spray gave large increases in yield and size of tomatoes. In 1960, tests were again set up on two types of tomatoes: Michigan-Ohio (red), and Wilt-Re-

sistant No. 7 (pink). The tests were made in a mylar plastic house and a glass house. This gave 4 different tests each with 4 replications, or 16 trials. The hormone-boron fertilizer gave highly significant increases in most instances, doubling the early yields and giving large increases in the size of the fruit. However, the increases in total yields were not significant.—E. M. Emmert.

**Dusting vs spraying of boron and hormone on tomatoes.**—Dusting is much easier and more complete than spraying, especially in a greenhouse. Dusting should be efficient if done at the right time in the field. Results in 8 different houses showed that boron-hormone dust gave higher yields than sprays of the same materials.

However, care must be taken to get the right concentration and not get too heavy a concentration on the vines at any one time. If no rainfall occurs to wash off excesses, there is danger of excessive accumulations. On several occasions burning occurred, but where not too severe, good increases of fruits still occurred.—E. M. Emmert.

**Effect of hormone spray and dusts on lima beans.**—The application of boron-hormone spray at regular concentration (1x) twice, and double regular concentration (2x) twice (at ten-day intervals) gave the highest yield, 353.2 bushels per acre. The check was 296 bushels per acre. Four 2 x concentrations from the start gave 350.8 bushels per acre.

Regular dust concentrations applied at three 10-day intervals gave 248 bushels per acre. A fourth application resulted in slightly less yield (246 bushels per acre.) The checks gave 231 bushels per acre.

Thus it seems that spray gave best yields. However, it will be noted that the check average was 296 on the spray as compared to 231 for the dust plots. The dust plots were infested more heavily with crab grass, which probably accounts for the lower yield.—E. M. Emmert.

**Pickling cucumber research.**—Two locations were used in testing various levels of nitrogen, potassium, side-dress nitrogen, and plant population on the yield and quality of pickling cucumbers. Results show no yield response to nitrogen and potassium, while a slight increase in yields resulted from side-dressing 40 pounds of nitrogen per acre at late fall-over time. The effect of close spacing was to produce higher early yields. Higher total yields at close spacing occurred at one location.

Results obtained with brined stock from a similar experiment conducted in 1959 show no effect of nitrogen, phosphorus, or potassium on fruit color, bloating, or firmness. A less firm pickle resulted from the nitrogen side-dress plots but no differences were noted on color or bloating.—Donald J. Cotter.

**Double plastic mulch.**—The use of black plastic continued to give a week to 10 days' earliness on vegetables and also resulted in large increases in total yields. These total increases are very large in a season of restricted rainfall.

However, this year, increases over black alone were recorded on

plots which had black in the usual manner but also received a layer of thin clear plastic in addition. The clear plastic was placed over the black with soil particles separating them so that a dead-air space was formed. The sun going through the clear caused a very high build-up of heat between the clear and black layers. Much of this heat was transferred through the black plastic to the soil, causing 10 to 15° F increases in soil temperature in the day and several degree increases at night over the black alone. The clear plastic breaks down after several months, but lasts long enough to give the desired stimulation in early spring. Crops used were snap beans, pole beans, lima beans, cabbage, sweet corn, and tomatoes.—E. M. Emmert.

**Plastic field houses without artificial heat.**—It has been found that lath can be done away with on field houses. This reduces the cost of the houses to about six or seven cents a square foot, including labor, materials, and plastic for all four layers used. The plastic is applied by weaving it over two sash bars and under one, then over two and under one, and so on. This installation has withstood winds up to about 50 miles an hour and held well. As yet, winds of 60 or more miles per hour have not occurred on these houses.

The new method of installing the plastic makes ventilation on the sides easy, since the plastic is simply slid up and holds well in winds.

Labor of ventilation can be done away with by use of fans. Fans drawing air in from the outside and blowing out under the inner dead-air layer of plastic does an efficient job of air exchange and reducing high humidity.

Several crops do well in field houses where four layers of plastic are used (two on the structure and two over the crop).

Lettuce grows well without heat, growing slowly even in severe winter weather. Tomatoes which have been started in early August can usually be held until Christmas, or even longer, without heat. Lettuce started in late January and early February does well, maturing in late March and April. Tomatoes started in late February or early March mature the last of May and during June.—E. M. Emmert.

**Relative humidity control in plastic greenhouses.**—Results with a circulation system in a plastic greenhouse indicate that relative humidity 2 feet above the soil level averaged 10-12% less than a comparable area in a normally ventilated house. This may be due to the higher and more uniform temperatures (8°F.) during the night and on cold days when the circulation system was active.

Ventilating with the same system resulted in cooler and more uniform greenhouse temperatures as well as requiring less attention and labor in the changeable weather periods during spring and fall.

The fan system resulted in less disease incidence (leaf mold, Botrytis rot, and bacterial rot) on tomatoes, and comparable or superior yields, fruit set, shape and color.—Donald J. Cotter.

**Air exchange by fans in the greenhouse.**—The increase on tomato fruit production from air introduction and circulation was highly significant. Early yields were four to five times as much as where no



air introduction or circulation was used.

Since there is no question about the benefits of moving air and air introduction, two methods were compared for getting air introduction and circulation. One was to hang the fan overhead and the other was a fan set on the path that drew air out of the top of the house and blew it along the path. The overhead method seemed good when plants were young and low, but when they got high they stopped the circulation. The fan in the path did the best job, and generally the yields were higher with it. In addition, the fan in the path was much cheaper to install than the overhead fans. Air introduction and circulation was accomplished by the fans when the vents were open and air circulation alone with the vents closed.—E. M. Emmert.

**Strawberry breeding.**—One hundred twenty-four selections from the breeding program were fruited in 1960. Twenty-six of these were selected for further evaluation. They were evaluated for freezing and ice cream by taste panel. One of these, 12-51-10, rated higher than any other selection or variety for freezing. It will be released as a variety in 1961. All of the 26 selections saved rated satisfactory in shipping tests.

Approximately 12,000 seedlings from the 1958 crosses fruited in 1960. Two hundred seventy selections were made from these seedlings and have been increased for planting in 1961.

Approximately 7,500 seedlings from 13 crosses were planted in 1960 and will fruit in 1961.

Approximately 75,000 seeds were planted from the 1960 crosses and will be planted in the field in 1961.—Carl E. Chaplin.

**Strawberry variety trials.**—Thirteen varieties of strawberries were fruited at Lexington and Eden Shale in 1960. Yields at Eden Shale were exceptionally high, ranging from 826 24-quart crates per acre for Pocahontas to 265 crates per acre for Red Star. The top yielder at Lexington was Dixieland with 498 crates per acre. The top five at each location and their production were as follows:

At Lexington: Dixieland, 498; Pocahontas, 336; Empire, 425; Sure Crop, 421; and Red Glow, 417.

At Eden Shale: Pocahontas, 826; Dixieland, 739; Early Dawn, 647; Blakemore, 520; and Sure Crop, 514.

Empire was the only variety in the first five at either location that would not be satisfactory as a Kentucky variety—it is too soft. Blakemore ranked No. 9 at Lexington, and Tennessee Beauty No. 10. Tennessee Beauty ranked No. 8 at Eden Shale.—Carl E. Chaplin.

**Strawberry mulching tests.**—First year Tennessee Beauty plants were used for these tests. Three treatments were arranged with straw mulch at rates of 2 tons, 1½ tons, and 1 ton per acre, and check plots were not mulched. Each treatment was replicated three times.

Fruit yields in 24-quart crates per acre were as follows: 2 tons, 373 crates; 1½ tons, 420 crates; 1 ton, 347 crates; and the check plot, 330 crates. These results were directly in line with similar tests conducted

several years ago in different areas of the state by W. D. Armstrong.—C. S. Waltman.

**Strawberry fungicide tests.**—Three fungicides (Captan, Thylate, and Cyprex) were applied five times to replicated plots of Pocahontas strawberries. Fruit rots and leaf diseases were no problem in the plots, and no significant differences were evident in control of diseases. There were no significant differences in production, fruit size, or soluble solids. Residues were below tolerance even when the fungicides were applied one day before harvest.—Carl E. Chaplin.

**Weed control in strawberries.**—Treatments with different rates of Sesone, Zytron, Karsil, Dacthal, Simazine, Atrazine, and Niagara 5996 were applied on new plantings of Tennessee Beauty strawberries. Zytron was used as an emulsifiable concentrate and granular formulation. Simazine, Atrazine and the emulsifiable Zytron, when applied at rates to obtain satisfactory weed control, either killed or severely injured the crop plants. Dacthal, Niagara 5996 and Zytron granules warrant further testing on new plantings of strawberries. Crag Sesone and Falone will be recommended for controlling weeds in strawberries during 1961.—J. W. Herron.

**Strawberry insect studies.**—(In cooperation with Entomology and Botany Department; see page 51.)

**European corn borer and corn earworm studies.**—(In cooperation with Entomology and Botany Department; see page 51.)

**The effect of different fungicides on Latham red raspberry cane mortality.**—Cane mortality during the dormant season has been the most critical problem which growers have had to contend with, and has also been the principal reason why raspberries have not attained a place of greater commercial importance in Kentucky.

Previous work has pointed to the fact that certain fungi causing defoliation were responsible for much of the cane damage. It seems desirable now to evaluate some of the newer improved fungicides with respect to their usefulness in controlling fungus diseases and possibly other diseases of raspberries.

The fungicides used were Captan, Manzate, Thylate, Dyrene, Zineb, Cyprex, and Phix. Applications were made at approximately two-week intervals throughout the summer.

The following table shows the average linear growth and fruit yields for each of the different treatments.

| Treatment     | Linear Growth,<br>inches | Fruit Yields<br>24-qt crates per A |
|---------------|--------------------------|------------------------------------|
| Thylate ..... | 7,359.5                  | 655                                |
| Captan .....  | 9,000.5                  | 579                                |
| Zineb .....   | 7,331.7                  | 548                                |
| Dyrene .....  | 6,782.5                  | 515                                |
| Manzate ..... | 9,080.7                  | 486                                |
| Cyprex .....  | 7,768.0                  | 411                                |
| Phix .....    | 6,827.3                  | 191                                |
| Checks .....  | 6,465.3                  | 496                                |

Fruit yields did not exactly parallel total linear growth although they ran fairly close together. A point which is not shown by the total linear growth measurements is the amount of killed cane tips which occurred on certain plots. This was particularly true of the plots sprayed with Phix and Cyprex, and during this past summer it was necessary to discontinue the use of Phix because of the amount of cane and foliage injury which it caused. Of the various fungicides used, the best results came from Captan, Thylate, and Zineb.—C. S. Waltman.

**Black raspberry variety yield records.**— This year's production was the second for a planting of three varieties at Lexington: Cumberland, New Logan, and Bristol. Fruit yields in 24-pint crates per acre in 1960 were: Bristol, 360; New Logan, 264; and Cumberland, 223.

These yields in the second producing year were considerably above those of the first bearing year, and Bristol continued to be the highest producer. Crop prospects for 1961 as measured by new cane growth appear to be exceptionally good. The planting was well mulched and the application of different fungicides on replicated areas of the different varieties should give a good measure of their effectiveness in disease control.

Second-year results at the Eden Shale Farm in 1960 were: Bristol, 153.4 crates per acre; New Logan, 110.0 crates per acre; and Cumberland, 76.7 crates per acre. The Cumberland variety was noticeably infected with virus, but the other varieties did not show visible symptoms.—C. S. Waltman.

**Blueberry trials.**— One of the principal difficulties in blueberry production has been bird control. This year an automatic acetelene gun was used to scare birds. It was regulated to fire about every 10 to 15 minutes. It was quite effective in keeping birds out of the planting. However, the noise was objectionable.

Production was good for three-year-old bushes. Berkeley averaged 3.7 pints per bush, followed by Herbert with 3.34 pints, and Coville with 3.1 pints per bush.

Fertility trials were begun to study the effects of nitrogen rates, complete fertilizer, and sources of potassium on growth and fruit production.—Carl E. Chaplin.

**Food technology.**— Vegetables processed by freezing in 1959 were evaluated during the fall, winter, and spring of 1959-1960. Taste panel ratings and objective quality measurements were made on varieties of snap beans, Blue Lake pole beans, sweet corn, broccoli, and small-seeded lima beans. Wadex, Top Crop, Tenderlong-15, and B-3125 were judged the best of 14 varieties of snap beans; and 27802, Sixty Pak, Asgrow Golden 22, and NK 1304 were the best of 14 varieties of sweet corn. Early Green Sprouting broccoli and Blue Lake #228 pole beans were the best of three varieties tested for each of these vegetables. Utah 16 and Wasatch Bush were rated better than three other varieties of small-seeded lima beans.

In the 1959-60 gamma irradiation studies, promising results were



obtained with sweet corn when the product was sealed in nitrogen and held at 35° F. Samples were still rated as acceptable 300 days after irradiation. Work is continuing with irradiated strawberries even though an acceptable product has not yet been obtained. Adverse effects of irradiation on broccoli were so great that tests with this crop have been discontinued.

During the summer of 1960 over 2,200 packages of vegetables were frozen for variety-quality evaluation and 450 packages of strawberries were frozen for quality studies in the strawberry breeding program.—Dudley C. Martin and Doris Tichenor.

**Variety testing of vegetables for processing.**—Early spring broccoli and cauliflower were failures due to spring drought followed by hot weather. (Number of varieties grown and best ones are in parentheses.) Spring cabbage (3, Marion Market) grew very well. Small-seeded lima beans (5, Henderson Bush) and vegetable soybeans (7, Jogun and Kim) produced better than average yields. Fall crops of broccoli (9, Early CT and K&V), cabbage (8, Penn. State Ballhead and Copenhagen Market), and cauliflower (5, Snowball E) had very high yields and excellent quality.—D. C. Martin.

**Fertilization requirement of container-grown nursery stock.**—Fertility studies during 1960 indicate that of 15 fertility treatments on container-grown nursery stock, best growth was obtained by applying a water soluble fertilizer every 10 days throughout the growing season. A 20-0-20 or 20-0-10 fertilizer at the rate of 1.68 pounds per 100 gallons of water gave the best results. Long-lasting fertilizers added to the soil mix also gave good results. Four pounds of urea formaldehyde, 6 pounds of 20 percent superphosphate and 4 pounds of potassium frit per cubic yard of soil mix resulted in good growth of *Ilex crenata rotundifolia*, *Magnolia soulangeana*, *Euonymus alatus compacta*, and *Pyracantha coccinea* Lalandi.

Soil tests indicate that for many species growing in containers, soil nitrogen should be maintained between 75 and 100 parts per million and soil potassium between 275 and 325 parts per million. Higher concentrations resulted in reduced growth due to excess fertilizer salts.

Container-grown nursery stock should be fertilized with one and one-half to two pounds of a 20-0-20 or 20-0-10 fertilizer in 100 gallons of water and one pint of this solution applied per plant every 10 days throughout the growing season. If less than one pint of solution is applied per plant, the amount of fertilizer should be increased proportionately.—James D. Kelley.

**Plant propagation and photoperiodism.**—Stock plants of *Weigela* Bristol Ruby and *Pyracantha coccinea* Lalandi were grown at low, medium, and high levels of soil nitrogen and received day-length treatments of 10 hours, 16 hours, 10 hours of light plus 2 hours of light during the middle of the dark period, 22 hours, and normal day length.

Rooting of cuttings taken from *Weigela* plants was not influenced by soil nitrogen level or photoperiod of the stock plant. *Pyracantha*

cuttings rooted best when taken from plants growing at low or medium levels of nitrogen. Photoperiod did not influence rooting response. The greatest number of cuttings was produced by plants receiving low and medium levels of nitrogen fertilization.

A number of woody ornamental plants were found to respond to long-day treatments. Long days caused increased vegetative growth on *Ilex cornuta burfordi*, *Weigela Bristol Ruby*, *Pinus sylvestris*, *Viburnum rhytidophyllum*, *Osmanthus americanus* and *Ilex crenata rotundifolia*.—James D. Kelley.

**Keeping quality of pot plants.**—Four varieties of chrysanthemums and one variety of Easter lily were treated with gibberellic acid in order to determine its influence on keeping quality and flower size.

Chrysanthemums were sprayed with eight concentrations of gibberellic acid ranging from 0 to 1,000 parts per million. Flower buds at the time of application were in three stages of development, tight bud, buds showing first sign of color and loose bud stage. No significant differences were noted between treated and untreated plants in regard to days from treatment to full bloom, days to petal browning, stem length, and flower diameter.

Easter lilies, variety Croft, were treated with foliar application of gibberellic acid at three stages of bud development. Buds were 6, 4½, and 3 inches long at the time of treatment. Concentrations of gibberellic acid used were 0, 100, 200, 300, 400, 500, 1000, and 1500 parts per million with Tween 20 as a wetting agent. Gibberellic acid at all concentrations resulted in a slight increase in length of flower, and produced a significant increase in keeping quality as measured by petal wilt and browning. Gibberellic acid at 1,000 and 1,500 parts per million extended the life of flowers from the normal 6 days to slightly over 8 days. Stage of development at time treated did not influence the effectiveness of treatments. Treatments did not hasten flowering or increase flower diameter.—James D. Kelley.

**Mineral nutrition of Japanese Yew.**—Two clones of Japanese Yew, Hicksi and Browni, are being grown in sand culture. Treatments consist of three levels of nitrogen, phosphorus, and potassium in all combinations. The purpose of this study is to determine the best levels and ratios of nitrogen, phosphorus, and potassium for these clones. The influence of nutrition on winter color is also being studied. Preliminary results indicate the poor winter color may be due to low calcium and high potassium. A combination of high nitrogen and high potassium also resulted in a poor winter foliage color.—James D. Kelley.

**Research in floricultural crops.**—Cymbidium orchid plants were collected and their blooming habits catalogued for reference against later treatments to be given. (1961-62). These plants were obtained as mature plants from the Dos Pueblos Orchid Company at Goleta, California. First year blooming records were not reliable as most of the flower spikes had been established by the time of receipt. Clonal material was divided so as to obtain large groups to be used in 1961-62.

Materials and methods for growth substance analysis have been established and the systems put into operation.

Blooming and growth records are now in the process of being established for the second year. Supposedly, results from the second year will be reliable as to time and quantity of flowering.—Jan W. Abernathie.

**Weed control in ornamentals.**—Comparative time studies of hand weeding vs. chemical weeding were made in plots of *Taxus media wardii*. Of the chemicals applied, Simazine gave best weed control and reduced the cost of hand weeding 42 percent.

Over 90 percent control of chickweed in *Taxus* spp. and *Junipers* spp. was obtained with post-emergence applications of Neburon. Neburon also gave good control of chickweed and henbit in pansy plant beds when the material was applied six weeks following transplanting of the pansies. Although no injury to the plants was observed, there appeared to be a slight delay in flowering of the treated plants. Simazine and Neburon will be recommended for controlling annual weeds in certain ornamentals in 1961.—J. W. Herron.

**Weed control in lawns.**—Dacthal, Zytron, and Calcium Arsenate, when applied as pre-emergence treatments, controlled crabgrass during the entire growing season. All three herbicides will be recommended for crabgrass control in 1961.

Maleic Hydrazide and Zytron were the herbicides included in the nimblewill control experiments. Maleic Hydrazide controlled nimblewill more consistently than Zytron, but also caused more severe injury to bluegrass.—J. W. Herron.

## POULTRY

**Results of high temperature on laying pullets.**—To determine the effects of high environmental temperature on egg production and egg quality factors, temperature in a hot room at 75° to 95° F was compared with a constant temperature of 70° F in an air-conditioned room.

Percent hen-day production was adversely affected by temperatures above 85° F. While egg weight increased in the air-conditioned room throughout the experiment, the egg weight in the hot room was significantly reduced. Percentage of shell decreased significantly as the temperature rose above 85° F.

Haugh unit values were approximately equal throughout the experiment. Body weights were reduced but not significantly in the hot room, and feed consumption was also reduced, but not significantly. These results will be of value in combating harmful effects of high temperature.—John J. Begin, Robert Grainger, D. W. MacLaury, and W. M. Insko, Jr.

**Effects of dietary fat and cellulose on apparent calcium digestibility in growing chickens.**—Three preliminary trials were conducted on the interrelationships of cellulose, fat, and calcium to determine



the need for further studies. The results indicated that dietary fat had adversely affected calcium metabolism. A more interesting observation was that dietary cellulose had lowered the apparent digestibility of calcium. This effect, so far as investigators at this station can determine, has not been reported before.

An experiment was conducted to determine the effect of various levels of dietary fat and cellulose on apparent calcium digestibility, percent bone ash, and the formation of ether insoluble soaps in growing chickens. Statistical analysis of the data secured indicate that: (1) apparent calcium digestibility was decreased at the 4.62 and 9.24 percent dietary fat levels; (2) apparent calcium digestibility was decreased at the 3, 6, and 12 percent dietary cellulose levels; (3) percent bone ash was not affected by dietary fat and/or cellulose levels; (4) dietary fat level did not affect the formation of ether insoluble fecal soaps; and (5) there was a highly significant negative correlation between apparent calcium digestibility and the formation of ether insoluble soaps.—John J. Begin, Robert Grainger, and W. M. Insko, Jr.

**Relationship of plumage color to body weight.**—Reciprocal matings were made of the Kentucky Station New Hampshires and White Plymouth Rocks to study relationship between plumage pattern and 8-week body weight. No relationship was found between weight and feather color or feather pattern.—D. W. MacLaury, W. M. Insko, Jr., and T. H. Johnson.

**Tolerance of chick embryos to elevated temperature.**—Knowledge of probable mortality of chick embryos under elevated temperature would aid hatcherymen in their planning after equipment or power failure. The estimated temperature required to kill half of the embryos in a one-hour exposure ranged from 115° F on the first day to 108.3° F on the twentieth day. For a two-hour exposure the corresponding figures were 111.5° F and 107.1° F and for a three-hour exposure they were 111.6° F and 107.0° F.

When data were analyzed to determine the length of exposure required to kill one-half of the embryos, none of the exposures at 105° F were sufficiently long. At 110° F, the time ranged from more than three hours in early stages to 45 minutes on the 20th day. At 112.5° F, exposure time ranged from 90 minutes on the third day to 30 minutes from the twelfth day on. At 115° F nearly all embryos died within an hour except on the first and sixth days, when the time was less than 90 minutes.—D. W. MacLaury and W. M. Insko, Jr.

**Effect of fiber in all-mash laying diets.**—Previous studies conducted at the two Kentucky Substations indicated that oats when fed as a supplemental grain with mash gave superior results when compared to corn or a mixture of corn, oats, and wheat. This experiment was designed to investigate the optimum level of oats in an all-mash laying diet and to determine whether other fibrous feedstuffs would have the same beneficial effect. The diets were formulated using a corn-soybean oilmeal basal, 3 levels of oats, and 3 levels of cottonseed hulls,

with the same fiber content for each of the levels. Inclusion of ground oats up to a level of 30 percent had a stimulatory effect on egg production. Both percentage lay and feed conversion were improved. The addition of 60 percent oats adversely affected production and feed conversion. When equivalent fiber levels from cottonseed hulls were added, both egg production and feed conversion were adversely affected. The cause for this may be due to: (1) difference in fiber structure between oats and cottonseed hulls; (2) oats may supply nutrients not found in cottonseed hulls; (3) an inhibitor may be present in cottonseed hulls.

An effort to improve a low protein diet by lowering the energy content was not successful.—John J. Begin and W. M. Insko, Jr.

## RURAL SOCIOLOGY

**Farmers' personal and social characteristics and the process of adopting new ideas in farming.**—If a farmer's adoption of new farming ideas is viewed as the final step in a process which started with contact between the farmer and sources that transmitted the new idea, differences among farmers in the extent to which they use or apply the new ideas may be regarded as the result of two sets of factors: (1) factors that motivate farmers to have contact with sources of information, thus affecting the number of new ideas they become familiar with, and how fast they do it, and (2) those that determine whether or how fast he tries new ideas once he knows about them. Information from farmers in Washington county, Kentucky, suggests that further understanding of the adoption process may be gained by dividing the sources from which farmers get new ideas into institutionalized farm information media, such as agricultural agencies, and the mass media news sources, such as newspapers, magazines, and radio.

Among Washington county farmers, the higher the farmer's education, socioeconomic status, scale of farming, and participation in formal social organizations, and the more favorable his attitude toward scientific farming, the greater is his inclination to have contact with institutionalized farm information media. Once a farmer learns of a new idea in this manner the probability that he will use it is directly related to his scale of farming operations and how favorable his attitude is toward new farming ideas. The study indicated, however, that farmers past 50 years of age are notably more reluctant to put new ideas into practice than are younger farmers.

The larger the farmer's scale of operations and the greater his participation in formal social organizations, the more extensive his contact with mass media farm information sources is likely to be. Farmers who have had more than an eighth-grade education and those who have high levels of participation in formal social organizations are most likely to try new ideas obtained through mass media.—C. M. Coughenour.

**Components of population change and percent due to net migration, for state economic areas, metropolitan areas, and counties in Kentucky, 1950-1960.**—During the last decade Kentucky's population increased from 2,944,806 to 3,038,156, or by only 3%—the lowest decennial rate of increase in history. The reason for the slow growth rate becomes evident when the components of population are examined—natural increase (excess of births over deaths) and net migration (the number of persons coming into the State less those leaving it).

In the 1950's, natural increase was about 469,000 but there were 376,000 more out-migrants than in-migrants. Natural increase was about 2,000 more than in the 1940's but the loss through migration was 8,000 more. So the gain in total population was slightly less, 93,000 from 1950 to 1960, compared with 99,000 from 1940 to 1950.

All 4 metropolitan areas and 6 of the 10 nonmetropolitan economic areas had greater natural increases than in the preceding decade. In several of these the gains were startling: The excess of births over deaths in the 1950's as compared with the 1940's was greater by 85% in Metropolitan Area A (Jefferson county); 75% in Metropolitan Area B (Campbell and Kenton); 160% in Metropolitan Area D (Fayette); and 83% in State Economic Area 3b (the West Central Kentucky Knobs Area). The in-migration of young people of child-bearing ages is the main reason for these great gains.

The four nonmetropolitan areas whose natural increase declined between the 1940's and the 1950's all had had heavy losses through migration in the preceding decade, as well as during the 1950's. They lost many young people of child-bearing age and hence had fewer births, but retained greater proportions of older people so that the number of deaths did not decrease as much as elsewhere. These areas, with their percentage decreases in excess of births over deaths between the 40's and the 50's are: SEA 3a (Western Kentucky Coal Field)-35%; SEA 5 (The South Central Kentucky Highland Area)-38%; SEA 8 (Eastern Kentucky Hills Area)-31%; and SEA 9 (Eastern Kentucky Coal Field)-33%.

Among the metropolitan areas, only Jefferson county and Fayette county made net gains through migration, the former 22,000 (only half the gain of the preceding decade), the latter 13,000 (nearly 10 percent more than in the 1940's). The Boyd and Campbell-Kenton areas had net losses due to migration during both decades, with the losses of the 1940's somewhat greater than those of the 50's.

Only SEA 3b (West Central Knobs) among the nonmetropolitan areas had a net gain through migration, and this was somewhat less than in the 1950's. But 8 of the 9 other nonmetropolitan areas had smaller losses through migration in the 50's, their total net loss being 220,000 (compared with 296,000 in the 1940's). On the other hand, SEA 9 (The Eastern Coal Field) had an astonishing net loss through migration of 208,000, about 72,000 more than in the 1940's, and this nearly offset the decreasing losses in the other nonmetropolitan areas.—James S. Brown.



**Health self-assessment of older persons in rural and urban Kentucky.**—In 1959, health data were collected from a sample of 1,236 men and women aged 60 and over, living in rural Casey county and in the city of Lexington and adjacent urban areas. The rural older persons, compared to the urban older persons, reported poorer physical, social, and psychological health. For example, substantially more rural than urban older persons (1) said that they were bothered either all the time or off and on with one or more symptoms of ill health (73 compared to 62 percent), (2) reported that they had cut down on their activities because of their health (72 vs. 44 percent), and (3) agreed with the statement, "In spite of what some people say, life for me is getting worse, not better" (48 vs. 33 percent).—E. Grant Youmans.

**County agents' activities and soil-building practice rates of counties.**—Data from Kentucky county agents' annual reports and similar sources were analyzed in an investigation of whether there is a relationship between a county's ranking on the use of soil building practices and the activities of the county agent in the county. An index of the use of soil-building practices was constructed from the percentage of farms in each county using fertilizers, the percentage using lime, and the number of soil tests per 100 farms in the county during the year.

It was assumed that differences among counties on the index of soil-building practices may be due to (1) characteristics and activities of county extension agents and other "change" agents, (2) farmers' characteristics, and (3) characteristics of the situation in which farmers learn about new ideas in soil building and make farm-practice decisions. By means of regression analysis much of the variation between counties in soil-building practice rates due to characteristics of types (2) and (3) above was removed. The remaining differences were found to be related to: (1) the annual number of farm visits by agents, (2) the annual number of result demonstrations, (3) the number of days spent in extension organization and planning, and (4) the number of news articles and stories prepared. Residual differences among counties in soil-building practice adoption rates were curvilinearly related to all activities of county agents analyzed except the number of news articles and stories. For maximum impact on soil-building practices the optimum range in number of farm visits was from 601 to 770 annually; in result demonstrations, 103 to 150; and in days spent in organization and planning work, 40 to 69.—C. M. Coughenour.

## REGULATORY AND INSPECTION SERVICES

**Creamery license section.**—Licenses to buy milk or cream from producers issued and in force totaled 293, of which 286 were renewals and 7 were issued to buying places beginning operation after July 1. The total included 2 creameries, 17 cheese plants, 12 condenseries, 80 milk plants and ice cream manufacturers, and 182 cream buying stations.

Authority to test for the period ending June 30, 1961 was issued to 479 operators of the Babcock test. These included 420 renewals, 34 licenses issued since July 1 following satisfactory examination, and 25 permits pending examination issued since July 1.

Testers on permit given examinations for license during the year totaled 64; of these testers examined 61 passed, 3 failed, and of those failing, 1 qualified later.

Persons who were authorized to sample and weigh for the period ending June 30, 1961 totaled 460. Of this number 349 hold licenses, 322 having renewed July 1 and 27 having been examined and found qualified since July 1, 1960. Forty-five were examined and found qualified between January 1 and June 30, 1960. The remaining 111 hold permits pending examination. The above total (460) includes persons who sample and measure milk in farm bulk tanks; they number 274, of which 194 are licensed.

A total of 8,639 milk and cream test bottles, cream test weights, and milk pipettes were calibrated for accuracy. Items of operating equipment in use found on inspections to be incorrect or defective and possible cause of inaccurate weights or tests were: hot water baths, 4; centrifuges, 3; pipettes, 8; tests bottles, 31; automatic samplers, 4; lights, 4; refrigerators, 6; sink, 1; 9 gram cream tests weights, 2; pair of dividers, 1; and scales 11. These were condemned and ordered to be replaced or repaired.

Tank checks made totaled 17. Special studies conducted totaled 8.

During the year 554 inspections, including 10,357 tests were made. Operators were graded as follows: A & B (satisfactory), 461 operators; C (unsatisfactory), 76; and D (probation), 17.

At the close of the year (December 31, 1960) all buying places have been licensed. All buyers have according to our records, licensed samplers and weighers and licensed testers as required by the law.

Receipts for the year were as follows:

|                                       |                    |
|---------------------------------------|--------------------|
| Operator's Licenses .....             | \$ 2,851.50        |
| Buyer's licenses .....                | 9,903.10           |
| Glassware, testing and stamping ..... | 294.14             |
| Total receipts .....                  | <u>\$13,048.74</u> |

The receipts include Remittance Reports no. 2354 dated January 13, 1960 through no. 2381 dated December 31, 1960, inclusive.

**Feed, fertilizer, and pesticide control.**—The number of fertilizer samples analyzed reached the all-time high for this state of 4,584. An additional 404 special samples of fertilizer were analyzed in connection with a study of sample variation undertaken in cooperation with Dr. W. G. Duncan of the Department of Agronomy. This study involving a statistical rating and comparison of grades, plants and companies has attracted wide national interest.

Official feed samples totaled 3,699, a decline from the number analyzed in 1959. The number of pesticide samples also declined slightly to 346.

Collaborative work on phosphorus and potash and on analysis of drugs and pesticides, was continued.

The tonnage of fertilizer sold in Kentucky for the year was 568,000 tons. This compares with a little over 600,000 tons in 1959. Feed tonnage stood at 580,652 tons for the year. A total of 3,570 pesticide products were registered during 1960.

**Nursery inspection.**—Production and demand for ornamental nursery stock have continued to increase. Good public relations between the Experiment Station and members of the nursery industry have been maintained or improved. The increased interest and activity by the Department of Horticulture have contributed substantially to this improvement.

Among the plant regulatory problems on a nationwide scale, the soil-infesting nematodes are receiving increased interest. So far Kentucky-produced nursery stock has not been involved in interstate regulations in relation to these nematode infestations.

The soybean cyst nematode infestation in Fulton and Ballard counties has been kept under close supervision. Additional properties infested with this nematode are being located by the survey crews. These properties are not new infestations but rather are properties which were infested several years ago and just now are reaching the nematode population level where detection is possible. Some increase in regulated areas was made during the year. The regulations are being handled in such a manner as to permit orderly marketing of farm commodities with a maximum of safeguard against spread of the pest. Cooperation has been quite good.

The Japanese beetle picture has followed the expected pattern. Treated areas have shown excellent control. Newly located infestations have been soil-treated in the usual way—10% granular heptachlor at the rate of 30 pounds per acre. Approximately 800 acres in Harlan county with a few acres in Bell, Knox, Jefferson, and Boone received soil treatment this year.

One specimen of the white-fringed beetle (*Graphognathus leucoloma striatus* (Buchanan)) was found on September 23, 1960, along the Illinois Central Railroad tracks in the town of Fulton, Kentucky. This is the first record of this insect in our state. Approximately fourteen acres, adjacent to the find, were soil treated with 10% heptachlor (granular) at the recommended rate of 30 pounds per acre.

**Seed testing.**—During the year 7,709 samples of seed were tested. Of this total number 847 were official samples taken by inspectors from the stock of wholesale and retail merchants. The remaining 6,862 samples were service samples sent to the laboratory by farmers, seedsmen and others. The total samples included 3,592 of grass seed, 1,953 of legumes, 1,386 of cereals, 483 of tobacco, and 295 of miscellaneous seed (lawn mixtures, rape, vegetables, etc.). Of all samples 5,512 were analyzed for purity and 7,463 tested for germination.

Our laboratory collaborated with the Association of Official Seed Analysts of North America on referee samples and seed research.



## ROBINSON SUBSTATION

**Evaluation of commercially available dent hybrids.**— Fifty-six hybrids compared at the Substation ranged in yield from 77.5 to 135.4 bushels per acre. Forty-one commercial yellow hybrids produced an average of 112.1 bushels per acre. Fifteen commercial white hybrids ranged in yield from 89 to 112.7 bushels, with an average of 110.7 bushels per acre. Marked variation existed among the hybrids for resistance to lodging, ear height, and resistance to the northern and southern corn leaf blight.—Frank A. Loeffel, J. F. Shane, and Charles Derrickson.

**Sorgo variety test.**— During the 1960 season ten sorgo varieties were grown at the Substation. The test was laid out in randomized blocks of five replications.

Stalk samples of each of the ten varieties were sent to the U. S. Department of Agriculture, Sugar Crops Field Station, Meridian, Mississippi, for milling, juice analysis, and syrup processing. Varieties grown were Wiley, Sart, Tracey, Mer 56-8, Mer 56-12, Mer 58-11, Mer 58-12, Wiley, Sugar Drip, Umbrella and Ky. 58-209.

Varieties yielding the highest tons per acre of stripped stalks were Wiley, 18.4; Tracey, 17.3; Umbrella, 17.3; and Sart 17.2. The average yield of the eleven varieties was 15.5 tons of stripped stalks per acre.

Forty experimental sorgo varieties were grown in an observation nursery for determination of disease resistance, standability, and general adaptability.—James F. Shane and Charles M. Derrickson.

**Western crossbred ewes mated to slow, medium, and rapidly gaining Southdown rams.**— The third year's study of Western crossbred ewes mated to slow, medium, and rapidly gaining rams was conducted at this Substation. All ewes were managed and fed together except during the breeding season, when the ewes were divided into three groups. The lambs were all creep-fed and all ran on pasture with the ewes until they weighed approximately 80-85 pounds. Lamb weights were recorded at birth, twenty-eight days, fifty-six days, one hundred days, and at slaughter.

Due to the large percentage of the ewes not lambing this year, little can be given on the results of this year's study. The fast-gaining ram group averaged 114 percent lamb crop, the medium-gaining ram group only 56 percent lamb crop, and the slow-gaining ram group 72 percent lamb crop.—P. G. Woolfolk and Charles M. Derrickson.

**The effect of protein level on laying house performance.**— It has been estimated that protein and energy content in the laying ration make up approximately 90 percent of the total feed cost. Energy costs the poultryman approximately 50 percent of his total cost. Protein costs about 40 percent of the total, while vitamins and minerals contribute about 10 percent of the cost of the feed. Any reduction in either the protein or energy cost would be extremely important in the economics of producing eggs.

Protein requirements for laying hens has been reported to be anywhere from 12 to 18 percent. The reasons for this wide variation in protein requirements are: (1) the relationship between protein and energy content of the ration, (2) temperature, (3) protein source, and (4) type of bird. This experiment was designed and conducted to answer the question, "What is the protein requirement for egg-type hens under Kentucky conditions?"

Day-old White Leghorn female chicks were obtained from a commercial breeder. All chicks were brooded and range-reared as a unit. Feed and management during the brooding and growing period were identical for all groups. One hundred and forty pullets were housed in September in each of four identical 20 by 20 foot pens.

The rations were formulated from corn, soybean oilmeal, meat scraps, alfalfa meal, vitamins, and minerals, and contained 12, 14, 16, and 18 percent protein. All diets were fed as an all-mash with oyster shell free choice. Feed consumption, mortality, egg production, and egg weight records were kept.

A diet with 12 percent protein was not satisfactory for maintaining optimum production and its use increased laying house mortality. Optimum results were not obtained on 14 percent protein laying diet. The requirement for optimum production was approximately 16 percent protein. No improvement in laying house performance was noted when the protein level was increased to 18 percent.—John J. Begin, W. M. Insko, Jr., and Charles M. Derrickson.

**Plastic laying house.**—Second year tests of the value of plastic for covering poultry houses were conducted. The 30' by 60' gable roof framework constructed in 1958 was covered with an opaque plastic roof and clear plastic side panels for use in this study. The house was divided into three pens. One pen 30'  $\times$  25' contained 536 White Leghorn hens, one pen 25'  $\times$  15' contained 113 New Hampshire pullets, and one pen 25'  $\times$  15' contained 114 White Rock pullets. The hens were housed in September and the pullets in October. All the birds were fed a 20% laying mash and a limited amount of grain.

Temperature readings were recorded daily. Readings in the plastic house were compared with readings taken in a boxed poultry house. Average daily temperature recordings showed the plastic house to be three to four degrees cooler in the summer months than the boxed house.

Performance of both yearling hens and pullets was quite satisfactory in this type structure. Egg production was about normal: 48.3% production from the White Leghorn hens, 67.4% production from the New Hampshire pullets, and 60.2% from the White Plymouth Rock pullets. Mortality rate was exceptionally low for all birds: 8.8% mortality for the White Leghorn hens and the New Hampshire pullets, and only 5.3% for the White Rock pullets.

These two-year results indicate that the plastic house provides adequate environment for poultry.—John J. Begin, D. W. MacLaury, W. M. Insko, Jr., and Charles M. Derrickson.

**Vegetable variety testing.**—Field vegetable trials were confined to a few varieties grown with and without 1 to 1½ inch of sawdust mulch. Sawdust used as a mulch has given increased yields and requires less labor to control weeds on these crops.

In 1959, a dry year, the yields of most vegetables were more than double. In 1960, a wet year, the experiment with sawdust mulch on new plots resulted in higher yields. On plots mulched in 1959 and again in 1960, the crops showed a nitrogen deficiency and yields were slightly reduced.

Potato yields were higher and the tubers were larger, smoother and more uniform with the sawdust mulch. Potato seed treatment gave erratic results on plots that were mulched in 1959-60 and again in 1960. The favorable results of sawdust mulch and the erratic results of seed treatment were sufficient to justify further studies of this work.—Donald J. Cotter and Charles M. Derrickson.

**Greenhouse tomato variety test.**—Ten varieties of tomatoes were tested in the greenhouse for varietal adaptability. The spring crop ranged in yield from 9.30 to 12.50 pounds per plant. The fall crop ranged from 4.09 to 5.10 pounds per plant.

Varieties and pounds per plant were: Morton Hybrid, 11.4; Spartan Hybrid, 10.42; WR-3, 10.13; Michigan State Forcing, 9.92; Michigan-Ohio Hybrid, 10.97; and WR-7, 9.39. Two varieties, Tuckcross-O and Tuckcross-W, were used only in two replications. Tuckcross-W averaged 11.78 and Tuckcross-O 12.50 pounds per plant.—Donald J. Cotter and Charles M. Derrickson.

**Strawberry variety test.**—Strawberry test plots gave good yields for the third bearing year: Pocahontas 355, 24-quart crates per acre; Tennessee Beauty, 215; and Blakemore, 161. The averages for three years on the same planting were 408 crates per acre for Pocahontas, 264 for Tennessee Beauty, and 211 for Blakemore.

Late winter applications of 0-20-20 fertilizer brought no increase in production. Some of the 62 selections of strawberries taken from the breeding program made good yields and showed good quality for future new varieties.—Carl E. Chaplin and Charles M. Derrickson.

**Blueberries.**—Seven varieties of blueberries planted in 1958 have made good growth, with fair yields. The following varieties are listed in order of production: Herbert, Berkley, Earliblue, Coville, Bluecrop, Jersey, and Concord.

The field appears to show irregularity in growth and some varieties have demonstrated better livability than others. The Jersey and Concord varieties have poorer stand than other varieties. All missing plants will be replaced in 1961.—Carl E. Chaplin and Charles M. Derrickson.

**Dwarf apple varieties.**—The dwarf apple orchard bore a good scattering of fruit in the fourth growing season. Varieties on Malling



IX root stock produced more apples per tree than varieties on root stock No. VII.

Three varieties on both root stocks (Red Delicious, Golden Delicious, and Stayman Winesap) have made good growth and show promise. The Jonathan variety, which did not do well on either root stock, was replaced with the McIntosh variety in the spring of 1960.—Carl E. Chaplin and Charles M. Derrickson.

**Pecans.**—Pecan yields were low in 1960. Yields on mature trees ranged from 15 to 50 pounds per tree. Green River gave the highest yield, 50 pounds per tree, while Major had only 15 pounds per tree. Young trees of the Green River, Major, and Gallatin varieties averaged about 5 pounds per tree. Insect damage was heavy on the Major variety.—Charles M. Derrickson.

**Comparative cost of using trinoxol 2,4,5-T in test areas and on actual commercial type operations in cull beech in timber stand improvement.**—Several factors cause the cost to vary considerably in different areas. Terrain, the wide variation in number and size of trees to be treated per acre, and the unpredictable ratio of working time to walking time, all cause variation in cost.

Following is a table showing a comparison of actual cost of the test area and a commercial type operation:

|                | <i>Test Area</i> | <i>Commercial Area</i> |
|----------------|------------------|------------------------|
| Material ..... | \$1.62 per acre  | \$0.92 per acre        |
| Labor .....    | \$2.39 per acre  | \$4.00 per acre        |
| Total .....    | \$4.01 per acre  | \$4.92 per acre        |

A somewhat wide variation in the cost of 2,4,5-T mix will show up because different people spray more on trees than others, and different size trees cause some difference. Our experience on the Robinson Forest shows the cost per acre to frill and poison the beech will vary from four to six dollars per acre when using 2,4,5-T.—Milton Noble and O. M. Davenport.

**Status of reproduction in the lower slope beech belt three years after heavy frilling and poisoning.**—In the summer of 1957 a heavy frilling and poisoning operation was done in Compartment No. 1 of the Coles Block on the Robinson Forest where a heavy concentration of cull beech was located on the lower slopes. After three years a 100-percent kill of all the treated beeches was obtained. During the summer of 1960 there was an estimated 22,900 stems of tree species reproduction per acre in the area.

The following species are the most important and are listed in a decending order of importance: Black Walnut, Yellow Poplar, Cucumber, Basswood, Northern Red Oak, and White Oak. These desirable species comprised 13.1 percent of the total species with an estimated 3,000 stems per acre. The less desirable to undesirable species are Hard Maple, Ash, Red Maple, Hickory, Beech, Black Gum, and Elm. These species made up 86.9 percent of the total.

From these figures it can be seen that adequate reproduction will come back immediately following removal of the cull beech. There

are enough stems per acre of the desirable species to make up the final crop of sawtimber. The problem will be to get them through all the other species competing with them.—Milton Noble and O. M. Davenport.

**Comparative cost of various silvicides in timber stand improvement work in cull beech on the Robinson Forest.**—The amount of cull beech on the Robinson Forest constitutes one of the biggest management problems on the forest, as well as on most other forest lands in Eastern Kentucky. At near the end of 1959 three areas in Compartment No. 25 of the Clemons Block were set up and replicated to be treated with three of the most common tree poisons.

In the summer of 1960 treatment was applied using sodium arsenite, trinoxol 2,4,5-T, and ammate (ammonium sulfate).

The sodium arsenite was applied with an eagle dripless oil can by cutting a frill around the tree with a hand axe (hatchet). The frill was cut just deep enough to reach the wood; then the frill was filled just enough to prevent overflow.

Since sodium arsenite is toxic and will be absorbed somewhat by the skin, it is advisable to put a protective coating of grease of some kind on the hands and forearms when working with it. In this work Kerodex 71, sold by most drug stores in tooth-paste-type tubes at \$1.50 per tube, was used. Extreme caution should be exercised in using sodium arsenite to prevent splashing it in the eyes. Glasses or goggles should be worn.

With care in preventing splashing and dripping the mixture in the woods and filling the frills so as to prevent overflow, danger to wild life is negligible.

The trinoxol 2,4,5-T was applied by cutting a frill around the tree with an axe and spraying the frill with a 3-gallon garden sprayer until overflow occurred; then the base of the tree from the frill down to the root collar or the ground level, was sprayed to just at the run-off point.

The ammate was applied by cutting a frill around the tree with an axe and the ammate crystals applied all around the frill by hand until the frill was full of the ammate crystals.

The costs of the several poisons, per acre, were:

|                           | <i>Sodium Arsenite</i> | <i>Trinoxol 2,4,5-T</i> | <i>Ammate</i> |
|---------------------------|------------------------|-------------------------|---------------|
| Protective material ..... | \$ .03                 | .....                   | .....         |
| Material .....            | \$ .63                 | \$ .62                  | \$ 8.18       |
| Labor .....               | \$1.64                 | \$2.39                  | \$ 2.38       |
| Total Cost per Acre ..... | \$2.30                 | \$4.01                  | \$10.54       |

If sodium arsenite is taken as 1.00, the comparative costs of the others are: Trinoxol 2,4,5-T, 1.74; and ammate, 4.59.—Milton Noble and O. M. Davenport.

## WESTERN KENTUCKY SUBSTATION

**Dairy pasture experiment.**—A 3-year study of the performance of Jersey dairy cows on renovated tall fescue-Ladino clover pasture versus nitrogen fertilized tall fescue pasture was completed. The pure

fescue plots were fertilized with 150 pounds nitrogen per acre annually in three applications. Clover content of the renovated pasture was low the first year, approximately 50 percent in spring of 1959, and only 10 to 15 percent in 1960.

For the fescue-Ladino and nitrated fescue, respectively, the average results for 3 years were: TDN production/acre/year, 2,357 and 3,327; persistency of milk production, 83 and 80 percent; change in body weight, 0.2 and 0.2 lb/day; dry matter intake/1,000 lb B. W., 22.8 and 22.4 lb/day; dry matter digestibility, 62.9 and 63.8 percent; protein digestibility, 65.5 and 69.0 percent. Of the values given the only difference between pastures which was statistically significant was that of TDN production per acre. Grain feeding had a statistically significant effect on persistency of milk production, 90.0 vs 73.6 percent for the cows that received no grain. The same was true for body weight gain, 0.36 vs 0.04 lb/day.

In this study the renovation of fescue and the attempt to establish Ladino appeared to give no advantage over grazing nitrated fescue.—Don R. Jacobson, W. C. Templeton, L. M. Caldwell, R. H. Hatton, and D. M. Seath.

**Effect of protein level on laying house performance of White Leghorn pullets.**—This test was conducted with four pens of 140 pullets each, for a period of 356 days, ending July 27, 1960. Results are summarized below:

|                                 | Pen C | Pen D | Pen E | Pen F |
|---------------------------------|-------|-------|-------|-------|
| Protein, % in all-mash .....    | 12    | 14    | 16    | 18    |
| Productive Energy Cal./lb. .... | 1028  | 963   | 965   | 936   |
| Average No. Eggs .....          | 226   | 252   | 253   | 257   |
| Hen Day Production (%) .....    | 63.5  | 71.2  | 71.7  | 72.8  |
| Mortality (%) .....             | 57.8  | 25.0  | 22.8  | 18.6  |
| Feed/Dozen Eggs (lb) .....      | 5.0   | 4.5   | 4.6   | 4.6   |
| Av. Egg Wt. (oz/doz) .....      | 24.5  | 24.4  | 25.0  | 24.9  |

The results indicate that approximately 14 percent protein is required for egg-breed laying hens under the condition of this experiment for the maintenance of optimum laying house performance. The data shows that 12 percent protein will not support maximum egg production. The percent mortality on the 12 percent protein diet was extremely high. There is little evidence from this trial which would indicate that higher levels of protein are beneficial in regard to egg production, mortality, feed efficiency or egg size.—S. J. Lowry, L. M. Caldwell, John J. Begin, and W. M. Insko, Jr.

**Protein supplements for growing-finishing pigs on concrete during winter of 1959-60.**—Fifty Duroc pigs averaging 47 pounds were used to test five protein supplements self-fed along with yellow shelled corn self-fed. Lot 1 received the basal supplement composed of soy-bean meal, minerals, Terramycin, and vitamins. Lot 2 received the basal supplement plus 2 pounds NF 180 per ton of supplement. Lot 3 received the basal supplement plus 3 pounds NF 180 per ton of supplement. Lot 4 received the basal supplement plus 4 pounds NF



180 per ton of supplement. Lot 5 received the basal supplement plus 400 grams of H.C. 0441 per ton of supplement.

The results were as follows:

| <i>Lot No.</i> | <i>Average<br/>Daily Gain</i> | <i>Feed Per<br/>100# Gain</i> |
|----------------|-------------------------------|-------------------------------|
| 1 .....        | 1.58                          | 331.90                        |
| 2 .....        | 1.62                          | 337.78                        |
| 3 .....        | 1.53                          | 347.28                        |
| 4 .....        | 1.57                          | 341.41                        |
| 5 .....        | 1.60                          | 332.50                        |

—C. E. Barnhart, J. R. Overfield, and S. J. Lowry.

**Antibiotics for growing-finishing pigs on concrete and pasture.**—Eighty Duroc pigs averaging 50 pounds were used to test two antibiotics. The basal ration was composed of ground yellow corn, soybean meal, meat scraps, steamed bonemeal, ground limestone, salt, trace minerals, Vitamins A and D, B complex, and B<sub>12</sub> feeding supplements.

Lot 1 received the basal ration. Lot 2 received the basal ration plus 40 grams Aureomycin per ton. Lot 3 received the basal ration plus 20 grams Virginiamycin per ton. Lot 4 received the basal ration plus 40 grams Virginiamycin per ton.

The results were as follows:

| <i>Lot No.</i>        | <i>Average<br/>Daily Gain</i> | <i>Fed Per<br/>100# Gain</i> |
|-----------------------|-------------------------------|------------------------------|
| <b>Concrete Trial</b> |                               |                              |
| 1 .....               | 1.89                          | 324.49                       |
| 2 .....               | 1.92                          | 323.74                       |
| 3 .....               | 1.93                          | 326.44                       |
| 4 .....               | 1.95                          | 314.94                       |
| <b>Pasture Trial</b>  |                               |                              |
| 1 .....               | 1.67                          | 319.29                       |
| 2 .....               | 1.72                          | 308.50                       |
| 3 .....               | 1.63                          | 320.16                       |
| 4 .....               | 1.78                          | 305.25                       |

—C. E. Barnhart, J. R. Overfield, and S. J. Lowry.

**Beef cattle.**—Forty steer calves averaging about 565 pounds were equally divided into two groups. One group was wintered at 1 pound per day and the other at 1.5 pounds per day. One-half of each group was implanted with 24mg stilbestrol. Stilbestrol increased daily winter gains 0.48 pound in the low-gaining group and 0.40 pound in the high-gaining group.

At the beginning of the summer phase each of the four winter subgroups was equally divided and one-half of each winter subgroup was implanted with 24mg stilbestrol.

The summer treatment, average daily gains and carcass grade (when Choice = 12, Good + = 11, Good = 10, and Good - = 9) for the group wintered at 1 pound daily gain were as follows: Control, 1.61 and 9.8; spring implant, 1.91 and 9.75; fall implant 1.70 and 9.0; fall and spring implant, 1.87 and 9.2. The summer treatment, daily gains, and carcass grade for the group wintered at 1.5 pounds per day

were as follows: Control, 1.42 and 9.8; spring implant, 1.86 and 9.4; fall implant, 1.40 and 10.2; spring and fall implants, 1.71 and 8.6. The steers implanted in the spring gained 0.29 pounds per day faster and returned \$9.42 more per head.—N. W. Bradley, J. R. Overfield, and S. J. Lowry.

**Ewe and lamb trial.**—The two groups of ewe lambs wintered on high and low levels of nutrition during the winter of 1956-57 are being used to study the effect of level of wintering ewe lambs on future lamb production and to produce lambs for a creep-feeding experiment. A group of 20 yearling black face Montana crossbred ewes were also used for producing lambs for creep feeding.

Lambing percentage and lambs sold per ewe were 158 and 1.21 for Lot I, the high wintered group; 150 and 1.25 for Lot II, the low wintered group; and 150 and 0.95 for the Montana ewes. On July 29, Lot II ewes were 6 pounds heavier than Lot I ewes, while this difference was only 2 pounds on December 2. This was the first year that Lot II ewes were heavier than Lot I ewes.

Two creep rations were used. Creep Ration No. I was composed of 90 pounds cracked corn, 10 pounds soybean meal, and 50 grams aureomycin per ton. Creep Ration No. II was composed of 67.5 pounds cracked corn, 25 pounds soybean meal, 5.0 pounds alfalfa meal, 1.5 pounds bonemeal, 0.8 pounds salt, 0.2 pounds trace minerals, and 50 grams aureomycin per ton.

The average market weight, average carcass grade (when Good = 9, Choice = 10, and Prime = 11), average yield, and average value per lamb were as follows:

| Ewe<br>Lot No. | Creep<br>Ration No. | Market<br>Weight | Carcass<br>Grade | Average<br>Yield | Average<br>Value |
|----------------|---------------------|------------------|------------------|------------------|------------------|
| I .....        | I                   | 88.33            | 10.75            | 52.68            | \$17.67          |
| I .....        | II                  | 87.27            | 10.64            | 52.96            | 17.66            |
| II .....       | I                   | 90.50            | 10.60            | 51.95            | 18.20            |
| II .....       | II                  | 89.00            | 10.60            | 52.57            | 19.85            |
| Montana .....  | I                   | 90.00            | 10.75            | 53.08            | 19.48            |
| Montana .....  | II                  | 86.36            | 10.64            | 51.88            | 17.66            |

—P. G. Woolfolk, J. R. Overfield, and S. J. Lowry.

**Control of suckers on dark tobacco.**—Experiments have been conducted since 1954 with maleic hydrazide and mineral oil emulsion on dark tobacco as sucker growth inhibitors. The mineral oil gave only fair and inconsistent control of suckers varying with the seasons. There was a tendency for some of the oil-treated stalks to rot. Mineral oil was not used after the first three years.

Maleic hydrazide 30% was used at 1 gallon and 1½ gallons per acre rates, mixed in 20 gallons of water and sprayed on the tobacco at topping time. Any suckers which developed on the treated tobacco were small and deformed and usually did not need to be removed until harvest time. The average yield and value of dark tobacco for the six years, 1954-1959, were:

| <i>Treatment</i>        | <i>Suckers<br/>Per Plant</i> | <i>Lb/<br/>Acre</i> | <i>Value<br/>Cwt</i> | <i>Acre<br/>Value</i> |
|-------------------------|------------------------------|---------------------|----------------------|-----------------------|
| Check—not treated ..... | 23.3                         | 1,659               | \$32.37              | \$537                 |
| MH-30 1 gal/acre .....  | 7.4                          | 1,826               | 34.45                | 629                   |
| MH-30 1½ gal/acre ..... | 2.7                          | 1,813               | 35.13                | 637                   |

—Leo A. Link.

**Fertilizer experiments with burley tobacco.**—A study is underway, comparing different rates of potash and the use of tobacco stalks for burley tobacco in two different 4-year rotations on limestone soil (Crider silt loam) and on sandstone soil (Tilsit silt loam). In one rotation (rotation A), burley tobacco is followed by 3 years of grass and legume hay. The second rotation (rotation B), consists of 2 years of burley followed by 2 years of grass and legume hay. Early results indicate that rotation A will produce burley of higher yield and quality than rotation B with the same fertilization. The study has not progressed far enough to determine fully the effect of the tobacco stalks. In favorable growing seasons the sandstone soil has produced burley of yield and quality equal to that grown on the limestone soil. However, burley growing on sandstone soil was more seriously damaged by adverse conditions such as a drought or an excess of rain.—L. A. Link.

**Fertilizer rates for dark tobacco.**—An experiment is underway to determine the most favorable amount of potash and nitrogen that should be applied for dark tobacco to obtain both good yield and a leaf of desired quality. The experiment has not been underway long enough to draw definite conclusions; however, certain trends are developing. During the past three seasons, on land which is manured at 10 tons per acre, there has been no advantage in applying more than 100 pounds per acre of  $K_2O$  from chemical fertilizer for either yield or value per pound. There has been a tendency for the higher potash rates to cause the leaf to be thin and to lack the desired body required in certain tobacco trades.—L. A. Link.

**Rates of nitrogen in a two-year rotation of corn and wheat.**—The effects of different rates of nitrogen are being studied in a 2-year rotation of corn and wheat. A mixture of lespedeza and clover is sown in the wheat in early spring but no hay is harvested. Nitrogen is used at rates of 0, 30, 60, and 120 pounds per acre for each corn crop, and at half these rates as a spring top-dressing for each wheat crop. Sufficient phosphate and potash are applied to each crop for high yields.

The wheat has given an increase in yield for each additional amount of nitrogen; however, the wheat lodges badly at the highest nitrogen level and a very poor stand of legumes is obtained at this rate. The good stand of legumes obtained at the low nitrogen levels are now probably supplying sufficient nitrogen for good corn yields following, but there is not enough nitrogen carried over in the soil after the corn for high wheat yields. The average corn and wheat yields in bushels per acre in the 2-year rotation were:



| Corn              |           | Wheat            |           |
|-------------------|-----------|------------------|-----------|
| Treatment         | 1956-1960 | Treatment        | 1955-1960 |
| 0-200-150 .....   | 83.0      | 0-200-150 .....  | 21.8      |
| 30-200-150 .....  | 87.3      | 15-200-150 ..... | 32.3      |
| 60-200-150 .....  | 88.5      | 30-200-150 ..... | 38.2      |
| 120-200-150 ..... | 91.1      | 60-200-150 ..... | 44.8      |

—L. A. Link.

**Soybean varieties.**—Of the four recommended varieties for southern and western Kentucky, Clark and Perry ranked second and third in the test for yield, with 35.4 and 35.2 bushels per acre respectively; however, the other two, Hood and Ogden, were eighth and twelfth in rank, with 32.3 and 27.4 bushels per acre respectively. Kent, a recently released variety, was top-yielding at 41.3 bushels per acre.—J. F. Freeman and Randolph Richards.

**Winter barley varieties.**—Thirty-six varieties and selections were compared in a rod-row test and seven selections and varieties were tested in drill-sown plots. An experimental selection, Ky. 50-5400, was top-yielder in the drill-sown test, 68 bushels of grain per acre. The recommended varieties Dayton, Kenbar, Kenate, and Hudson yielded 55.7, 55.9, 62.1, and 61.5 bushels per acre, respectively, in the rod-row test.—V. C. Finkner, Leo A. Link, and Randolph Richards.

**Winter oats varieties.**—Very high yields and good test weights were recorded among six varieties and selections in a drill-sown test, as well as among the 44 varieties and selections in a rod-row test. Dubois, the stiffest-strawed entry in the drill-sown test, was the highest yielder with 127.8 bushels per acre. The top-yielder in the rod-row test was a Kentucky experimental selection, which yielded 97.5 bushels per acre. The recommended varieties; Dubois, Forkedeer, Atlantic, and Bronco had yields of 78.1, 83.6, 85.3, and 82.9 bushels per acre, respectively, and test weights of 38.8, 38.5, 35.3, and 35.9 pounds per bushel, respectively.—V. C. Finkner, Leo A. Link, and Randolph Richards.

**Winter wheat varieties.**—Ten varieties were compared for performance in a drill-sown test and thirty-six selections and varieties were included in a rod-row test. The yields of the five recommended varieties; Dual, Knox, Todd, Vermillion, and Vigo in the rod-row test were 49.5, 45.4, 40.7, 48.9, and 46.2 respectively. Test weights of the recommended varieties were: Dual, 57.5; Knox, 59.2; Todd, 55.9; Vermillion, 59.4; and Vigo, 57.8.—V. C. Finkner, Leo A. Link, and Randolph Richards.

**Grain sorghum varieties.**—Thirty open-pollinated varieties and hybrids were planted in 42-inch rows and row-cultivated. A closed-pedigree hybrid had the highest yield in the test, which was 90.4 bushels per acre. The recommended varieties Martin, Midland, Plainsman, and R. S. 610 had yields of 67.6, 56.5, 36.9, and 78.5 bushels per acre, respectively. Their respective test weights were 59.2, 54.5, 56.7, and 55.2 pounds per bushel, respectively. Plainsman, averaging 31 inches in height, was the shortest of the recommended varieties; however, the hybrid R. S. 610 which was 46 inches tall, is short enough to

be combined with relative ease.—J. F. Shane, Leo A. Link, and Randolph Richards.

**Forage crops.**—Of the various forages tested in 1960, the recommended alfalfa varieties had the following yields in tons of dry matter per acre: Narragansett, 3.35; Buffalo, 3.20; and Atlantic, 2.96. Ranger wasn't included in this test. Over a four-year period Narragansett has outyielded ten other varieties. No differences were noted in the performances of Clair timothy from breeders, foundation, or registered seed classes; but all three were better than commercial seed. Results from red clover work are reported in the agronomy section of the 1960 annual report.—W. H. Stroube, Leo A. Link, and Randolph Richards.

**Corn.**—An experiment comparing six hybrids of different maturity ranges at different rates and dates of planting has been conducted since 1957. The following table summarizes the data from the 1960 test:

| <i>Date of Planting</i> | <i>Yield<br/>Bu/Acre</i> | <i>Rate of Planting</i>  | <i>Yield<br/>Bu/Acre</i> |
|-------------------------|--------------------------|--------------------------|--------------------------|
| April 25 .....          | 87.4                     | 8,000 plants/acre .....  | 73.0                     |
| May 16 .....            | 86.9                     | 12,000 plants/acre ..... | 84.0                     |
| May 31 .....            | 79.3                     | 16,000 plants/acre ..... | 87.9                     |
| June 14 .....           | 73.1                     |                          |                          |

—F. A. Loeffel, Leo A. Link, and Randolph Richards.

**Elberta peach fertilization plots.**—These 11-year-old Elberta trees are divided into low, medium, and high nitrogen plots, getting 1, 2, or 4 pounds of ammonium nitrate each year, or its equivalent. One third of the plots also get some phosphate and potash. In 1960, the low-nitrogen trees averaged 375 pounds of fruit each, while the medium trees produced 398 pounds, and the high-nitrate trees averaged 426 pounds of fruit each. At the medium and high nitrogen rates, the addition of P and K did not increase the yields in 1960. However, with the low nitrogen trees, the ones also getting P and K produced 30 pounds more of fruit each.—W. D. Armstrong.

**Apple varieties.**—Some promising apple varieties that bore well in their sixth growing season were: Henry Clay, Mantet, Melba, Milton, Oriole, Boyd Duchess, Barker Paducah, Redwell, Wealthy, Red Grovenstein, Minjon, and Turley. Red Hook blighted so badly in 1959 and 1960 that it was discarded.

Apple varieties that bore well and looked promising on older trees were: Close, Lodi, Yellow Transparent, Fireside, Minnesota 790, Starr, Polly Eades, Red Melba, Paducah, Grimes, Jonathan, Cortland, Conard, Macoun, Turley, Wright, Rome, Ruby, Neosho, August Tart, and Norwell.

A new local seedling, a yellow summer apple, known as the Hardrick, is showing great promise and is being closely watched. Neosho, a red fall apple, is also a commercial prospect.—W. D. Armstrong.

**Peach varieties.**—Varieties that produced heavy satisfactory crops in 1960, listed in their general order of ripening, were: (Note: all are yellow fleshed except where "W" follows the variety name) Earlired

(B9-134), Cardinal, Dixired, Sunrise, Prairie Sunrise, Late Sunhaven, Redhaven, Golden Jubilee, Ranger, Prairie Rose, Regina, Nectar (W), Fireball, Mo. 899, Loring, Redglobe, Richhaven, Halehaven, July Elberta, Icy's Delight, Ozark, Sullivan, Brayberta, B7-1029, Stoney (W), Earlihale, Blake, H. H. Brilliant, Redskin, Elberta, Mo. 1009, Mo. 1052, Shippers Late Red, Rio Oso Gem, Supernuts, Laterose (W), Afterglow, Autumn, and Roberta.

Of special interest is the Late Sunhaven, a bud sport of Sunhaven, that matures about three days ahead of Redhaven, which it resembles, but sets fruit lighter; hence does not require such heavy thinning.

Suggested discards are: Coronet and Keystone for failure to bear regular crops; Fairhaven because of internal fruit browning; So-Good because of tenderness to dormant bud killing; and Stoner because of small fruit size.—W. D. Armstrong.

**Strawberry varieties.**—Earlidawn was outstanding in 1960 at Princeton and at several other Kentucky points, as a very early, heavy fruiting, good quality home use and nearby sales variety, worthy of trial and small scale production. The Dixieland variety, which is becoming of increased importance in Kentucky, produced heavily this year, as did Blakemore, which is now on the decline in Kentucky. Tennessee Beauty, the leading strawberry variety in Kentucky, and Pocahontas, now the second ranking variety, produced well but were not as outstanding as usual. Surecrop, the new red stele resistant variety of the U.S.D.A., seems to be the best variety available to use on soils infected with the red stele disease.

About 100 selections from the Kentucky strawberry breeding program were also fruited and some showed qualities that, after further observation, may qualify them as worthy of introduction as new varieties.—W. D. Armstrong.

**Dwarf apple trees.**—To date, the Malling VII semi-dwarfing stock has been the most effective of the Malling root stocks planted here, since the work started in 1943. Others tested or still under test are the Malling Numbers I, II, IV, XII, and XIII.

Some 1950 plantings of the so-called inter-stem type dwarf apples are doing well, with Golden Delicious and Jonathan tops producing more satisfactorily to date than Red Delicious.—W. D. Armstrong.

**Nut tree work.**—Both Farrington and Thomas black walnuts bore good crops in 1960 on limestone soils, but failed, along with other varieties, on sandstone soils. The Farrington nuts filled well, but the Thomas nuts were mostly blasted, thus worthless. This general, usual failure of the Thomas variety to fill has caused it to lose favor rapidly in recent years, while the new Farrington continues to look promising.

Several newer varieties of Northern pecans, black walnuts and Carpathian walnuts (hardy English walnuts) are being established mostly as topworks for fruiting and for local graft wood production.

Chinese chestnuts are bearing regular crops of good seedling nuts, and are very promising.—W. D. Armstrong.



## PUBLICATIONS

## ANNUAL REPORT

Seventy-second annual report of the Experiment Station (for 1959). Frank J. Welch, Director, June 1960.

## BULLETINS

- 670. Characteristics of prices paid for Kentucky spring lambs. C. D. Phillips, R. L. Carter and Dana G. Card. May 1960.
- 671. Lamb fattening and digestibility studies with supplemental fat, erythromycin and diethylstilbestrol. N. Gay, R. B. Grainger, F. H. Baker and J. W. Stroud. May 1960.
- 672. Changes in the market movement of Kentucky livestock. Ernest D. Gooch and C. D. Phillips. June 1960.

## CIRCULARS

- 567. How Kentucky farm credit cooperatives are controlled. Wendell C. Binkley and Eldon D. Smith. April 1960.
- 571. How Kentucky rural electric cooperatives are controlled. Wendell C. Binkley and Eldon D. Smith. June 1960.

## KENTUCKY FARM AND HOME SCIENCE

(A quarterly journal of the Experiment Station, issued in the winter, spring, summer and fall.)

## Vol. 6, No. 1

- Tall fescue—a progress report (William A. Seay)
- The effects of parasitism (Stanley E. Leland, Jr.)
- Where does the Kentucky farmer's dollar go? (Robert W. Rudd and D. Milton Shuffett)

## Vol. 6, No. 2

- Problems of older rural persons (E. Grant Youmans)
- Studies on mites in Kentucky (J. G. Rodriguez)
- New equipment helps keep milk flavor uniform (A. W. Rudnick, Jr., T. R. Freeman and Carrol E. Graves)

## Vol. 6, No. 3

- Blood substance stops dairy cows from eating (Don Dowden and Don R. Jacobson)
- Decreasing heat in farm buildings (Frank B. Borries, Jr.)
- Varied research projects reported (Frank B. Borries, Jr.)
- It's fried chicken first in Kentucky (John B. Roberts)
- Lovell's tenure at Greenville Field is longest of U. K. field foremen (Eugene C. Doll)

## Vol. 6, No. 4

- Career plans of rural Kentucky high school seniors (Harry K. Schwarzweller)
- New poultry farm in operation (Thomas H. Johnson and W. M. Insko, Jr.)
- Kentucky research results in brief (Frank B. Borries, Jr.)

## MISCELLANEOUS PUBLICATION

- 204. A key to Kentucky soils. Joseph H. Winsor and H. H. Bailey. September 1960.

## REGULATORY BULLETINS

- 159. Semi-annual report, official fertilizer samples, July-December, 1959. February 1960.
- 160. Kentucky economic poisons report for 1959. March 1960.
- 161. Commercial feeds in Kentucky, 1959. May 1960.
- 162. Seed inspection in Kentucky, 1959-1960. June 1960.

163. Annual report of the Kentucky plant pest control law, 1960. September 1960.
164. Semi-annual report, official fertilizer samples, January-June, 1960. December 1960.

#### PROGRESS REPORTS

85. Results of the Kentucky grain sorghum performance tests, 1959. J. F. Shane. January 1960.
86. Results of the Kentucky hybrid corn performance test, 1959. F. A. Loeffel, J. F. Shane and H. R. Richards. January 1960.
87. Results of the Kentucky soybean performance, date of planting, and fertilizer tests, 1959. J. F. Freeman and S. H. Phillips. January 1960.
88. Socio-economic problems of older persons in Casey county, Kentucky. E. Grant Youmans. February 1960.
89. Results of the Kentucky hybrid popcorn performance trials, 1959. J. F. Shane, F. A. Loeffel and H. R. Richards. February 1960.
90. Results of the Kentucky sorgho performance test, 1959. J. F. Shane. February 1960.
91. Strawberry marketing in Kentucky, 1959. Willard H. Minton. March 1960.
92. Construction and heating of plastic greenhouses. E. M. Emmert. March 1960.
93. Kentucky farmers needs and sources of information. A. N. Halter. June 1960.
94. Career aspirations of rural Kentucky high school seniors. Harry K. Schwarzweller. July 1960.
95. Factors underlying milk output and supply responses in the Louisville milkshed. A. N. Halter, E. A. Proctor and L. H. Keller. November 1960.
96. Results of the Kentucky grain sorghum performance tests, 1960. J. F. Shane, H. R. Richards and Leo A. Link. December 1960.
97. Results of the Kentucky hybrid popcorn performance trials, 1960. F. A. Loeffel and J. F. Shane. December 1960.

#### RURAL SOCIOLOGY REPORTS

- RS-6. Population of the state, by counties, 1960 and 1950. James S. Brown.
- RS-7. Population growth and change, net migration and total births and deaths, eastern Kentucky counties, 1940-50 and 1950-60. James S. Brown.
- RS-8. Tables showing components of population change and percent due to net migration for state economic areas, metropolitan area, and counties, southern Appalachians, 1950-60. James S. Brown.

#### SCIENTIFIC PAPERs

##### *Agronomy*

- Contributions of physiology to plant breeding (red clover). W. A. Kendall. Southern Pasture and Forage Improvement Conference, Fayetteville, Ark., 1960. In press.
- Cross-compatibility of annual and perennial ryegrasses with tall fescue. Robert C. Buckner. *Agron. Jour.* 52:409, 1960.
- Difference in the behavior of the *Nicotiana longiflora* wildfire resistance locus in the tobacco varieties Burley 21 and Ky 61. G. W. Stokes. *Phytopathology* 50:770-772.
- Dry matter yield and botanical composition of an orchardgrass ladino white clover mixture under clipping and grazing conditions. T. H. Taylor, H. B. Washko and R. E. Blaser. *Agron. Jour.* 52:217-220, 1960.
- Effect of exchangeable calcium on the retention of phosphorus by clay fractions of soils of the Memphis catena. D. V. Calver, H. F. Massey and W. A. Seay. *Soil Sci. Soc. Amer. Proc.* 24:333-336, 1960.
- Effect of several factors on volatilization of ammonia formed from urea in the soil. J. W. Ernst and H. F. Massey. *Soil Sci. Soc. Amer. Proc.* 24:87-90, 1960.

- Effects of *Meloidogyne incognita* and *M. hapla* on the growth of Kenland red clover and Atlantic alfalfa. Richard A. Chapman. *Phytopathology*. 50:181-182, 1960.
- Effects of plant stress on the incidence of root rot in red clover. W. A. Kendall, Southern Pasture and Forage Improvement Conference, Fayetteville, Ark., 1960. In press.
- Haploidy in tobacco. Dreux de Nettancourt and G. W. Stokes. *Jour. Hered.* 51:102-104, 1960.
- Improvement of tall fescue for palatability by selection within inbred lines. Robert C. Buckner and E. N. Fergus. *Agron. Jour.* 52:173-176, 1960.
- Nine years' experience with the *Nicotiana longiflora* factor for resistance to *Phytophthora parasitica* var. *Nicotianae* in the control of black shank. W. D. Valleau, G. W. Stokes and E. M. Johnson. *Tob. Sci.* 4:92-94, 1960.
- Numerical classification of fertilizer company records. W. G. Duncan. *Ass'n. Amer. Fertilizer Control Officials*. No. 14:74-83, 1960.
- Occurrence of certain plant diseases in Kentucky in 1959. E. M. Johnson, R. A. Chapman and W. D. Valleau. *Plant Disease Reporter*. 44:159-161, 1960.
- Performance of inbred lines, polycross progenies and synthetics of tall fescue selected for improved palatability. Robert C. Buckner. *Agron. Jour.* 52:177-180, 1960.
- Population development of *Meloidogyne arenaria* in red clover. R. A. Chapman. (Abstract) *Phytopathology*. 50:631, 1960.
- Soil potassium reactions as related to clay mineralogy of selected Kentucky soils. M. G. Cook and T. B. Hutcheson, Jr. *Soil Sci. Soc. Amer. Proc.* 24:252-256, 1960.
- Technique for determining the reaction of seedling plants to *Thielaviopsis basicola*. L. Henson and G. W. Stokes. (Abstract) *Phytopathology*. 50:638, 1960.
- Use of computers in the analysis of fertilizer company records based on inspection samples. W. G. Duncan and Bruce Poundstone. *Ass'n. of Southern Feed, Fertilizer and Pesticide Control Officials*. Official publication, 1960-61.
- Use of polyethylene tubes for selfing tall fescue. Robert C. Buckner. *Agron. Jour.* 52:410, 1960.
- Animal Husbandry*
- A biological evaluation of urea with mature wethers. R. B. Grainger, D. Oberleas, F. H. Baker and J. W. Stroud. (Abstract) *Jour. An. Sci.* 19:1263, 1960.
- A photometric method of determining rancidity in pork fat. C. B. Ramsey, James D. Kemp and R. B. Grainger. (Abstract) *Jour. An. Sci.* 19:1241, 1960.
- Carcass evaluation, production and processing costs and consumer acceptance of light weight and normal hogs. Ray A. Fields, W. Y. Varney and James D. Kemp. (Abstract) *Jour. An. Sci.* 19:49, 1960.
- Cation-fat effect on cellulose digestibility by sheep. R. B. Grainger, M. C. Bell, J. W. Stroud and F. H. Baker. (Abstract) *Jour. An. Sci.* 19:1262, 1960.
- Effect of enzymes on nutrient digestion by wethers. R. B. Grainger and J. W. Stroud. (Abstract) *Jour. An. Sci.* 19:1263, 1960.
- Effects of partial pumping on the shrinkage, rancidity development and palatability of aged hams. George C. Skelley, Jr., James D. Kemp and W. Y. Varney. *Food Tech.* 16:446-448, 1960.
- Effects of pasture forages, including wild onions and weeds, on flavor of beef. W. Y. Varney and James D. Kemp. (Abstract) *Jour. An. Sci.* 19:1243, 1960.
- Factors affecting carcass characteristics of heavy grass and milk-fed calves. W. Y. Varney, James D. Kemp and N. W. Bradley. (Abstract) *Jour. An. Sci.* 19:1244, 1960.
- Influence of dietary calcium and zinc on calcium-45, phosphorus-32 and zinc-65 metabolism in swine. R. K. Berry, M. C. Bell, R. B. Grainger and R. G. Buescher. (Abstract) *Jour. An. Sci.* 19:1247, 1960.



- Potential of fat as an energy source for fattening beef cattle and sheep. R. B. Grainger, J. W. Stroud and N. W. Bradley. Proc. Distillers Feed Conference, Cincinnati, Ohio, March 1960.
- Relationship of feed intake and length of collection period to apparent digestibility of a self-fed pelleted lamb ration. R. B. Grainger, N. Gay and F. H. Baker. Jour. An. Sci. 19:1150-1152, 1960.
- Roughage-concentrate ration and relationship of calcium to fat-depressed cellulose digestion with sheep. R. B. Grainger, R. Anggorodi and J. W. Stroud. (Abstract) Jour. An. Sci. 19:1262, 1960.
- Temperature and light as factors in reproduction among farm animals. R. H. Dutt. J. Dairy Sci. (Supp.) 43:123, April 1960.

### *Animal Pathology*

- A catheter for nasal inoculation of large animals. E. R. Doll. Am. Jour. Vet. Res. 21(82):518-519, May 1960.
- Disease prevention. E. R. Doll. Proc. Illinois Short Course for Horse Breeders. University of Illinois, Urbana, Ill., February 1960, pp. 70-74.
- Effects of parasitism. S. E. Leland, Jr. Ky. Farm and Home Sci. 6(1):5-8, Winter 1960.
- Field studies comparing piperazine-carbon disulfide complex with carbon disulfide for parasite control in the horse. J. H. Drudge, S. E. Leland, Jr., Zae N. Wyant, George Elam and Beatrice Hutzler. Am. Jour. Vet. Res. 21:397-402, May 1960.
- Need for research on horses. E. R. Doll. Proc. Illinois Short Course for Horse Breeders. University of Illinois, Urbana, Ill., February 1960, pp. 87-98.
- Ovine vibronic abortion caused by a new variety of vibrio. John T. Bryans, Alice Smith and Alice Baker. Cornell Vet. 50(1):54-59, January 1960.
- Physiological properties of pathogenic and non-pathogenic vibrio species isolated from cattle, sheep and chickens. John T. Bryans, Alice Smith and Alice Baker. Cornell Vet. 50(3):331-358, July 1960.
- Research on parasitic diseases of horses. J. H. Drudge and Clarkson Beard. Blood Horse. 79(16):737-740, April 1960.
- Studies on *Trichostrongylus axei* (Cobbold, 1879). V. Some quantitative and pathological aspects of experimental infections of a horse strain in sheep. S. E. Leland, Jr., J. H. Drudge, Zae N. Wyant and George Elam. Am. Jour. Vet. Res. 21(82):449-457, May 1960.
- Studies on *Trichostrongylus axei* (Cobbold, 1879). VI. Total serum protein, blood and plasma volume and electrophoretic serum fractionation in infected and uninfected lambs. S. E. Leland, Jr., J. H. Drudge and Zae N. Wyant. Am. Jour. Vet. Res. 21(82):458-463, May 1960.

### *Dairy Science*

- Appetite—it's being studied for ways to improve animal performance. Don R. Jacobson. Poultry and Livestock Comment, Du Pont Co. 17(3), 1960.
- Blood substance stops dairy cows from eating. Don R. Dowden and Don R. Jacobson. Ky. Farm and Home Sci. 6(3):3, 1960.
- Comparison of feeding corn cobs and liquid urea-molasses-mineral mix with and without ethyl alcohol to yearling dairy heifers. J. P. Bates, Don R. Jacobson, J. W. Rust and D. M. Seath. J. Dairy Sci. 43:12, 1960.
- Effect of certain vacuum treatments on the flavor and physical characteristics of fluid milk. C. E. Graves, A. W. Rudnick, Jr. and T. R. Freeman. J. Dairy Sci. In press.
- Effect of feeding high grain rations upon numbers of facultative anaerobes in the bovine rumen. R. F. Wiseman, Don R. Jacobson, and W. M. Miller. Bacteriol. Proc. 32:3, 1960.

- Effect of minor changes in the ingredient composition of rations on rumen microbial activity. D. W. Claypool. *J. Dairy Sci.* In press.
- Inhibition of appetite in dairy cattle by certain intermediate metabolites. Don R. Dowden and Don R. Jacobson. *Nature*. 188(4745):148-149, Oct. 8, 1960.
- New equipment keeps milk flavor uniform. A. W. Rudnick, Jr., T. R. Freeman and C. E. Graves. *Ky. Farm and Home Sci.* 6(2):6-7, 1960.
- Persistence of lactobacilli and streptococci in the bovine rumen during penicillin administration. R. F. Wiseman, D. R. Jacobson and W. M. Miller. *Jour. Applied Microbiology*. 8:76-79, 1960.
- Poor hay dries 'em up! Don R. Jacobson. *Hoard's Dairyman*. 105 (10):570, May 25, 1960.
- Simplified method for counting anaerobic rumen bacteria. D. W. Claypool, Don R. Jacobson and R. F. Wiseman. *Trans. Tenn. Acad. Sci.* In press, 1960.
- Urea utilization by young dairy calves as affected by chlortetracycline supplementation. L. D. Brown, Don R. Jacobson, J. P. Everett, Jr., D. M. Seath and J. W. Rust. *J. Dairy Sci.* 43:1313-1321, 1960.
- Use of frozen cultures as a direct inoculum for making cottage cheese. A. W. Rudnick, Jr. and W. E. Glenn. *J. Dairy Sci.* 43:845, 1960.

### Entomology

- Effect of insecticidal sprays on hornworms and on *Apanteles congregatus*. Richard Thurston. *Jour. Econ. Ent.* 53 (3):976, 1960.
- Effects of soil insecticides and absorbants on plant sugars and resulting effect on mite nutrition. J. G. Rodriguez, Donald E. Maynard, H. H. Chen and Walter T. Smith, Jr. *Jour. Econ. Ent.* 53 (4):491-495, 1960.
- Effects of soil insecticides on apple trees and resulting effect on mite nutrition. J. G. Rodriguez, H. H. Chen and Walter T. Smith, Jr. *Jour. Econ. Ent.* 53 (4):487-490, 1960.
- Nutrition of the host and reaction to pests. J. G. Rodriguez. In publication No. 61 of the AAAS, "Biological and Chemical Control of Plant and Animal Pests," 1960, pp. 149-167.
- Phytotoxicity of insecticidal and spray treatments to burley tobacco. Richard Thurston and Claude F. Wade. *Tobacco*. 150(25):22-27 (*Tobacco Science*. 4:120-125), June 17, 1960.

### Home Economics

- Modification of student attitudes on guidance-of-children scales through classroom teaching. Helen R. Marshall, Jean G. Hobart, Barbara J. Cox, Lucille Magruder and Jessie W. Ringo. *J. Home Econ.* 52:185-190, 1960.
- On the research side—research suggests teachers test, rather than judge, social acceptance of preschool children. Helen R. Marshall. *Jour. Nursery Education*. 15 (2), Winter 1960.
- Relations between parent money education practices and children's knowledge and use of money. Helen R. Marshall and Lucille Magruder. *Child Development*. 31:253-284, 1960.

### Horticulture

- Applying methyl bromide. E. M. Emmert. *American Vegetable Grower*. 8(2):45, February 1960.
- Boron-hormone sprays and dusts for early, quality tomatoes. E. M. Emmert. *Proc. Sou. Agr. Workers 57th Annual Convention*, February 1960, p. 202.

- Christmas tree studies. O. M. Davenport. Fourth Annual Report on Ornamental Research in Each Southern State, February 1960, pp. 14-15.
- Effect of irrigation-fertility on yield and quality of tomatoes. D. J. Cotter. Proc. Sou. Agr. Workers 57th Annual Convention, February 1960, p. 167.
- Effects of post-transplanting herbicidal treatments on tomatoes. J. W. Herron and D. J. Cotter. Proc. joint meeting of North Central Wood Control Conference (16th) and Western Canadian Wood Control Conference (10th), December 1959, pp. 46-47. (Too late for last year's report)
- Interaction of snap bean varieties with fertility rates. Dean E. Knavel and D. J. Cotter. Vegetable Improvement Newsletter No. 2, compiled by H. M. Munger, Cornell University, Ithaca, N. Y., February 1960.
- Kill brush with pellets. J. W. Herron. Hoard's Dairyman. 105 (10):59-60, March 25, 1960. Reprinted in Am. Christmas Tree Growers Jour., August 1960, pp 50-51.
- Low-cost plastic field greenhouses without heat for out-of-season vegetables. E. M. Emmert. Proc. Sou. Agr. Workers 57th Annual Convention, February 1960, pp. 164-165.
- Now look in field greenhouses. E. M. Emmert. American Vegetable Grower. 8 (2):17, 59, February 1960.
- Research work in ornamental horticulture. James D. Kelley. Fourth Annual Report on Ornamental Research in Each Southern State, February 1960, pp. 13-14.

### *Rural Sociology*

- Career plans of rural Kentucky high school seniors. Harry K. Schwarzweller. Ky. Farm and Home Sci. 6 (4):3, 1960.
- Functioning of farmers characteristics in relation to contact with media and practice adoption. C. Milton Coughenour. Rural Soc. 25 (3):283-297, September 1960.
- Problems of older rural persons. E. Grant Youmans. Ky. Farm and Home Sci. 6 (2):3,8, Spring 1960.
- Progress report: southern Appalachian studies. Thomas R. Ford. Mountain Life and Work. 36:3, Fall 1960.
- Reliability and comparability of two instruments for determining reference groups in farm practice decisions. Gordon F. DeJong and C. Milton Coughenour. Rural Soc. 25 (3):289-307, September 1960.
- Reviews—J. U. D. Sanders, *Differential Fertility in Brazil* and J. D. Traver, *A Component Method of Estimating and Projecting State and Sub-divisional Populations*. Thomas R. Ford. Rural Soc. 25:4, December 1960.
- Section B: Occupational, educational and residence plans of Negro high school seniors in Lexington and Fayette county, Ky. A. Lee Coleman. Jour. Negro Education. Winter 1960.
- Social scientists, predictions about desegregation, 1950-1955. A. Lee Coleman. Social Forces. 38 (3), March 1960.
- Socio-economic study of rural older persons. E. Grant Youmans. Gerontological Society Newsletter, March 1960, p. 4.
- Status, residence and fundamentalist religious beliefs in the southern Appalachians. Thomas R. Ford. Social Forces. 39 (1), October 1960.

### THESES FOR DEGREE OF PH.D. OR M.S., UNIVERSITY OF KENTUCKY, CONCERNING EXPERIMENT STATION PROJECTS (UNPUBLISHED)

#### *Agronomy*

- Evans, J. K. The effects of clipping frequency and nitrogen on tillering, dry matter yield, corn weight and reserve carbohydrate content of clair timothy.
- Greer, Howard. The relation of phosphorus status in the soil, as affected by exchangeable calcium, to the uptake of phosphorus by plants.



Smiley, Jones H. Multiplication of *Pseudomonas tabaci* in diploid, triploid, and tetraploid *Nicotiana tabacum* plants with different doses of the *Nicotiana longiflora* gene for resistance.

#### *Animal Husbandry*

Christian, Joe C. Influence of environmental factors, estrual activity, lactation and reproductive hormones on body temperature of the ewe.

Field, Ray Arvid. Processing costs, market values and consumer acceptance of light and normal weight hogs.

Ramsey, Clovis Boyd. Microbiological and photometric methods of measuring rancidity in pork fat.

Simpson, Everett C. Semen production and fertility of rams following exposure to controlled ambient temperatures.

Skelley, George C., Jr. The effects of partial pumping on the shrinkage, rancidity development and palatability of aged hams.

Varney, William York. Factors affecting carcass characteristics of heavy grass and milk-fed calves. (Michigan State University, *in absentia*)

#### *Dairy Science*

Childress, Harold. A study of factors affecting conception rate of dairy cattle.

Dowden, Donald R. Normal intake variation and inhibition of appetite in the bovine by certain intermediate metabolites.

Heilman, Don. A study of production records of artificially sired Holstein cattle.

Ridgeway, Billy T. Factors affecting the number of cows bred artificially.

Summerhill, W. R., Jr. Levels of deoxyribonucleic acid in bovine spermatozoa and their relationship to fertility.

#### *Rural Sociology*

Aurbach, Herbert A. An empirical study in the application of the folk-urban typology of the classification of social systems.

DeJong, Gordon F. A comparison of two techniques for studying reference groups.

# FINANCIAL STATEMENT

Statement of Current Income and Expenditures  
of Federal Funds and Offset Funds Thereto  
for Fiscal Year Ending  
June 30, 1960.

## INCOME

|                                           |              |                       |
|-------------------------------------------|--------------|-----------------------|
| Federal:                                  |              |                       |
| Hatch Amended .....                       | \$725,228.00 |                       |
| Regional Research Fund 3 (c)3 .....       | 124,063.00   |                       |
| A.M.A. Title II .....                     | 17,500.00    |                       |
| Total Federal Funds .....                 |              | \$ 866,791.00         |
| Non-Federal Funds .....                   |              | 1,460,072.24          |
| Total Federal and Non-Federal Funds ..... |              | <u>\$2,326,863.24</u> |

## EXPENDITURES

|                               | <i>Federal</i>      | <i>Non-Federal</i>    | <i>Total</i>          |
|-------------------------------|---------------------|-----------------------|-----------------------|
| Personal Services .....       | \$699,735.41        | \$ 800,687.70         | \$1,500,423.11        |
| Travel .....                  | 12,255.56           | 10,594.44             | 22,850.00             |
| Transportation .....          | 448.71              | 1,566.43              | 2,015.14              |
| Communication Services .....  | 1,127.82            | 11,955.43             | 13,083.25             |
| Rents & Utility Service ..... | 343.43              | 52,091.62             | 52,435.05             |
| Printing .....                | 4,720.18            | 3,539.78              | 8,259.96              |
| Contractual Service .....     | 26,031.31           | 100,597.15            | 126,628.46            |
| Supplies & Materials .....    | 70,546.72           | 258,184.11            | 328,730.83            |
| Equipment .....               | 37,870.97           | 154,490.79            | 192,361.76            |
| Lands & Structures .....      |                     | 48,878.06             | 48,878.06             |
| Taxes & Assessments .....     | 13,710.89           | 17,486.73             | 31,197.62             |
| Total .....                   | <u>\$866,791.00</u> | <u>\$1,460,072.24</u> | <u>\$2,326,863.24</u> |





